2007 Data Report

ESOP

Environmental Surveillance and Oversight Program

D H E C

PROMOTE PROTECT PROSPER

South Carolina Department of Health and Environmental Control

www.scdhec.gov

Promoting and protecting the health of the public and the environment

CR-004111 1/09

South Carolina Department of Health and Environmental Control

Environmental Surveillance Oversight Program
Data Report for 2007

Region 5
Environmental Quality Control
Serving: Aiken, Allendale, Bamberg, Barnwell, Calhoun, and Orangeburg Counties
Promoting Health, Protecting the Environment

Region 5 EQC
206 Beaufort Street NE,
Aiken, SC 29801
(803) 641-7670 Fax (803) 641-7675

Introduction

The South Carolina Department of Health and Environmental Control's (SCDHEC) Environmental Surveillance and Oversight Program (ESOP) supports and complements SCDHEC's comprehensive regulatory program at the Savannah River Site (SRS) by focusing on those activities not supported or covered through our normal regulatory framework. The primary function of the ESOP is to evaluate the effectiveness of SRS monitoring activities. To accomplish this function, the ESOP conducts non regulatory monitoring activities on and around the SRS, conducts evaluations of the SRS monitoring program and provides an independent source of information to the public pertaining to levels of contaminants in the environment from historical and current SRS operations.

This report includes a description of the ESOP's multi-media monitoring network and activities along with a summary of the findings of the ESOP from the 2007 calendar year monitoring period.

Table of Contents

Introduction i

List of Illustrations iv

List of Data Tables v

List of Acronyms vi

Sampling Location Information xi

Chapter 1 2007 Air Monitoring

1.1 Radiological Atmospheric Monitoring

1.1.1 Summary 1
1.1.2 Map 5
1.1.3 Tables and Figures 6
1.1.4 Data 7
1.1.5 Summary Statistics 18

Chapter 2 2007 Water Monitoring

2.1 Ambient Groundwater Monitoring Adjacent to SRS

2.1.1 Summary 23
2.1.2 Map 28
2.1.3 Tables and Figures 29
2.1.4 Data 35
2.1.5 Summary Statistics 57

2.2 Drinking Water Quality Monitoring

2.2.1 Summary 59
2.2.2 Map 64
2.2.3 Tables and Figures 65
2.2.4 Data 70
2.2.5 Summary Statistics 78

2.3 Radiological Monitoring of Surface Water

2.3.1 Summary 81
2.3.2 Map 87
2.3.3 Tables and Figures 88
2.3.4 Data 102
2.3.5 Summary Statistics 116

2.4 Nonradiological Monitoring of Surface Water

2.4.1 Summary 120
2.4.2 Map 123
2.4.3 Tables and Figures 124
2.4.4 Data 130
2.4.5 Summary Statistics 141

2.5 Radiological and Nonradiological Monitoring of Sediments

2.5.1 Summary 147
2.5.2 Map 156
2.5.3 Tables and Figures 157
2.5.4 Data 175
2.5.5 Summary Statistics 198

Table of Contents

Chapter 3 2007 Terrestrial Monitoring

3.1 Surface Soil Monitoring

3.1.1 Summary 204
3.1.2 Map 213
3.1.3 Tables and Figures 214
3.1.4 Data 221
3.1.5 Summary Statistics 239

3.2 Radiological Monitoring of Terrestrial Vegetation

3.2.1 Summary 248
3.2.2 Map 260
3.2.3 Tables and Figures 261
3.2.4 Data 266
3.2.5 Summary Statistics 294

3.3 Radiological Monitoring of Edible Vegetation

3.3.1 Summary 299
3.3.2 Tables and Figures 305
3.3.3 Data 307
3.3.4 Summary Statistics 313

3.4 Radiological Monitoring of Dairy Milk

3.4.1 Summary 316
3.4.2 Map 319
3.4.3 Tables and Figures 320
3.4.4 Data 322
3.4.5 Summary Statistics 329

Chapter 4 2007 Biological Monitoring

4.1 Radiological Monitoring of Fish Adjacent to SRS

4.1.1 Summary 332
4.1.2 Map 338
4.1.3 Tables and Figures 339
4.1.4 Data 346
4.1.5 Summary Statistics 374

4.2 Radiological Game Animal Monitoring Adjacent to SRS

4.2.1 Summary 376
4.2.2 Map 379
4.2.3 Tables and Figures 380
4.2.4 Data 381
4.2.5 Summary Statistics 385

Chapter 5 2007 Critical Pathway Dose Report

5.1 Critical Pathway Dose Report

5.1.1 Summary 387
5.1.2 Tables and Figures 404
5.1.3 Data 415
5.1.4 Summary Statistics 423

References 425

Errata 434

List of Illustrations

Illustrations

Maps

Map 1. **ESOP Random Quadrant Locations** xv
Map 2. **Radiological Atmospheric Monitoring Locations** 5
Map 3. **Ambient Groundwater Network** 28
Map 4. **Drinking Water Monitoring Locations** 64
Map 5. **Radiological Monitoring of Surface Water Sample Locations for 2007** 87
Map 6. **Nonradiological Surface Water Monitoring Sample Locations** 123
Map 7. **Radiological and Nonradiological Monitoring of Sediment** 156
Map 8. **Surface Soil Monitoring Locations** 213
Map 9. **ESOP and DOE-SR Radiological Vegetation Sampling Locations, 2007** 260
Map 10. **Radiological Monitoring of Dairy Milk Locations, 2007** 319
Map 11. **Radiological Monitoring of Fish Sample Locations, 2007** 338
Map 12. **Cesium-137 Ranges in Game Animals Adjacent to SRS, 2007** 379

Tables and Figures

Radiological Monitoring of Air 6
Ambient Groundwater Monitoring 29
Drinking Water Quality Monitoring 65
Radiological Monitoring of Surface Water 88
Nonradiological Monitoring of Surface Water 124
Radiological and Nonradiological Monitoring of Sediments 157
Surface Soil Monitoring 214
Radiological Monitoring of Terrestrial Vegetation 261
Radiological Monitoring of Edible Vegetation 305
Radiological Monitoring of Dairy Milk 320
Radiological Monitoring of Fish 339
Radiological Game Animal Monitoring Adjacent to SRS 380
Critical Pathway Dose Report 404

Back to Table of Contents

List of Data Tables

Data Tables

Radiological Atmospheric Monitoring 7
Ambient Groundwater Monitoring Adjacent to SRS 35
Drinking Water Quality Monitoring 70
Radiological Monitoring of Surface Water 102
Nonradiological Monitoring of Surface Water 130
Radiological and Nonradiological Monitoring of Sediments 175
Surface Soil Monitoring 221
Terrestrial Vegetation Radiological Monitoring 266
Radiological Monitoring of Edible Vegetation 307
Radiological Monitoring of Dairy Milk 322
Radiological Monitoring of Fish 346
Radiological Game Animal Monitoring Adjacent to SRS 381
Critical Pathway Dose Report 415

Summary Statistics

Radiological Atmospheric Monitoring 18
Ambient Groundwater Monitoring Adjacent to SRS 57
Drinking Water Quality Monitoring 78
Radiological Monitoring of Surface Water 116
Nonradiological Monitoring of Surface Water 141
Radiological and Nonradiological Monitoring of Sediments 198
Surface Soil Monitoring 239
Terrestrial Vegetation Radiological Monitoring 294
Radiological Monitoring of Edible Vegetation 313
Radiological Monitoring of Dairy Milk 329
Radiological Monitoring of Fish 374
Radiological Game Animal Monitoring Adjacent to SRS 385
Critical Pathway Dose Report 423

Back to Table of Contents

List of Acronyms

8HLE	Eight half-lives elapsed
AGMN	Ambient Groundwater Monitoring Network
AGQMP	Ambient Groundwater Quality Monitoring Project
APW	Atmospheric Pathway
Avg	Average
"B"	Background samples (>50 miles from SRS)
BDC	Beaver Dam Creek
BNA	Base neutral/ acid extractable organics
BOD	Biochemical Oxygen Demand
CB	Crouch Branch
CDC	Centers for Disease Control
DER	Duplicate Error Ratio
DNR	Department of Natural Resources
DNRGW	Department of Natural Resources Groundwater Wells
DO	Dissolved Oxygen
DOE	Department of Energy
DOE-SR	Department of Energy - Savannah River
DW	Drinking Water
"E"	Perimeter samples (<50 miles from SRS)
EMS	Environmental Monitoring Section
EPA	Environmental Protection Agency
EQC	Environmental Quality Control
ESOP	Environmental Surveillance and Oversight Program
ESV	Ecological Screening Value
ETF	Effluent Treatment Facility
FGR	Federal Guidance Report
FMC	Fourmile Creek
FT AMSL	Feet Above Mean Sea Level
FT BGS	Feet Below Ground Surface
GA	Georgia
GOR	Gordon
GW	Groundwater
ICRP	International Commission on Radionuclide Protection
LLD	Lower Limit of Detection
LN	Lognormal
LPW	Liquid Pathway
LTR	Lower Three Runs Creek
LTRC	Lower Three Runs Creek
MB	McQueen Branch
MCL	Maximum Contaminant Level
MDA	Minimum Detectable Activity
MDC	Minimum Detectable Concentration
MDL	Minimum Detection Level
MEI	Maximum Exposed Individual
MFC	Membrane Fecal Coliform
MFFF	Mixed Oxide Fuel Fabrication Facility

List of Acronyms

N/A	Not Applicable
NaI	Sodium Iodide
NFEC	Naval Facilities Engineering Command
NH_4	Ammonium
NH_3	Ammonia
NO_2	Nitrite
NO_3	Nitrate
NORM	Naturally Occurring Radioactive Material
NSBLD	New Savannah Bluff Lock & Dam
ORWBG	Old Radioactive Waste Burial Ground
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PCE	Perchloroethylene
PRG	Preliminary Remediation Goals
PWS	Public Water System
PWSGW	Public Water System Groundwater Wells
PWSRW	Public Water System River Water
R	dry/wet weight ratio
RAC	Radiological Assessments Corporation
REMD	Radiological Environmental Monitoring Division
RW	River Water
SAS	Trademark Name of SAS Institute Inc., Cary, North Carolina
SC	South Carolina
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
SD	Standard Deviation
SMSV	Sediment from Savannah River Study area
SOP	Standard Operating Procedure
SP	Steed Pond
SRS	Savannah River Site
SS	Surface Soil
STC	Steel Creek
STEVENS	Stevens Creek
STOKES	Stokes Bluff Landing
SW	Surface Water
SWDF	Solid Waste Disposal Facility
TAL	Target Analyte List (metals)
TCE	Trichloroethylene
TEF	Tritium Extraction Facility
TENORM	Technologically Enhanced Naturally Occurring Radioactive Material
TKN	Total Kjeldahl Nitrogen
TLD	Thermoluminescent Dosimeter
TOC	Total Organic Carbon
TSP	Total Suspended Particulates
TSS	Total Suspended Solid
US	United States

List of Acronyms

USDOE	United States Department of Energy
USDOI	United States Department of Interior
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UTR	Upper Three Runs
U.S. 301	United States Highway 301
VEGP	Vogtle Electric Generating Plant
VOC	Volatile Organic Carbon
WRS	Wilcoxon Rank Sum
WSRC	Washington Savannah River Company (formerly Westinghouse Savannah River Company)

Back to Table of Contents

List of Acronyms

UNITS OF MEASURE

C	temperature in Celsius
cm	centimeter
cps	**c**ounts per second
d	days
g/cm^3	grams per cubic centimeter
g/L	grams/liter
h	hours
hr/day	hours per day
hr/yr	hours per year
kg/yr	kilograms per year
L	Liter
L/hr	Liters per hour
L/yr	Liters per year
m	minutes or when attached to radionuclide identification means metastable
m^3/yr	cubic meters per year
µg/L	micrograms per liter
µR/hr	micro rem per hour
µS/cm	microSiemens/cm
mg/day	milligrams per day
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mL	milliliter
mrem	millirem
mrem/yr	millirem per year
ntu	nephelometric turbidity units
pCi/g	Picocuries per gram
pCi/L	Picocuries per liter
pCi/m³	Picocuries per cubic meter
person-rem/y	Person-roentgen equivalent man per year
su	standard units
umhos/cm	specific conductance
±	Plus or minus. Refers to one standard deviation unless otherwise stated

Back to Table of Contents

List of Acronyms

Radionuclides and Associated Half-Lives

Ac-228	**Actinium-228**	**6.1 hours (h)**
Am-241	**Americium-241**	**432 years (y)**
Be-7	**Beryllium**	**53.4 days (d)**
Ce-144	**Cerium-144**	**284 d**
Cs-134	**Cesium-134**	**2.06 y**
Cs-137	**Cesium-137**	**30.1 y**
Cm-244	**Curium-244**	**18.1 y**
Co-58	**Cobalt-58**	**70.8 d**
Co-60	**Cobalt-60**	**5.27 y**
Eu-152	**Europium-152**	**13.6 y**
Eu-154	**Europium-154**	**8.8 y**
Eu-155	**Europium-155**	**4.96 y**
H-3	**Hydrogen-3 (tritium)**	**12.3 y**
I-129	**Iodine-129**	**1.57E7 y**
I-131	**Iodine-131**	**8.04 d**
K-40	**Potassium-40**	**1.27E9 y**
Mn-54	**Manganese-54**	**312.7 d**
Na-22	**Sodium-22**	**2.6 y**
Pb-212	**Lead-212**	**10.64 h**
Pb-214	**Lead-214**	**27 m**
Pu-238	**Plutonium-238**	**87.8 y**
Pu-239	**Plutonium-239**	**2.4E4 y**
Pu-240	**Plutonium-240**	**6.5E3 y**
Ra-226	**Radium-226**	**1.6E3 y**
Ra-228	**Radium-228**	**5.75 y**
Ru-103	**Ruthenium-103**	**39 d**
Sb-125	**Antimony-125**	**2.77 y**
Sr-89	**Strontium-89**	**50.6 d**
Sr-90	**Strontium-90**	**28.6 y**
Tc-99	**Technetium-99**	**2.13E5 y**
Th-238	**Thorium-238**	**1.9 y**
Th-234	**Thorium-234**	**24.1 d**
U-234	**Uranium-234**	**2.44E5 y**
U-235	**Uranium-235**	**7.03E8 y**
U-238	**Uranium-238**	**4.47E9 y**
Zn-65	**Zinc-65**	**244 d**
Zr-95	**Zirconium-95**	**64.0 d**

Back to Table of Contents

Sampling Location Information

Quadrant locations for DOE-SR Environmental perimeter random soil samples collected from 2004 - 2007. These locations were randomly selected from a quadrant system established by the U.S. Department of Interior on a 7.5' topographical map of South Carolina revision 10/92.

DOE-SR Environmental Perimeter		**Quadrant (Quad) Limits**
Random Quadrants Within SRS Perimeter "E"		**Inside of the 50-mile SRS Perimeter Zone**
Quad	**7.5' Quad Name**	**Latitude by Lat and Longitude by Long**
E1X&B2X	Furman (50mi.)	3237.5 by 3245 and -8107.5 by -8115
E2	Barnwell	3307.5 by 3315 and -8115 by -8122.5
E3X	New Ellenton, SE (SRSX)	3315 by 3322.5 and -8130 by -8137.5
E4	Aiken	3330 by 3337.5 and -8137.5 by -8145
E5	Ehrhardt	3300 by 3307.5 and -8100 by -8107.5
E6	Foxtown	3337.5 by 3345 and -8130 by -8137.5
E7X&B24X	Emory (50mi.)	3352.5 by 3400 and -8137.5 by -8145
E8	HarleysMillPond	3330 by 3337.5 and -8107.5 by -8115
E9	Monetta	3345 by 3352.5 and -8130 by -8137.5
E10	Norway West	3322.5 by 3330 and -8107.5 by -8115
E11	North	3330 by 3337.5 and -8100 by -8107.5
E12	Colliers	3337.5 by 3345 and -8200 by -8207.5
E13	Norway East	3325.5 by 3330 and -8100 by -8107.5
E14X	Jackson (NRX/SRS)	3315 by 3322.5 and -8145 by -8152.5
E15X	Evans (GAX)	3330 by 3337.5 and -8207.5 by -8215
E16	Denmark	3315 by 3322.5 and -8107.5 by -8115
E17X&B25X	Orangeburg S. (50mi.)	3322.5 by 3330 and -8045 by -8052.5
E18	Midway	3315 by 3322.5 and -8052.5 by -8100
E19X	Mechanics Hill (GAX)	3315 by 3322.5 and -8152.5 by -8200
E20	Kitchens Mill	3330 by 3337.5 and -8122.5 by -8130
E21	Clear Pond	3307.5 by 3315and -8100 by -8107.5
E22X&B26X	Grays (50mi.)	3237.5 by 3245 and -8100 by -8107.5
E23X	Kildaire(GAX)	3230 by 3237.5 and -8122.5 by -8130
E24X	Long Branch(SRS)	3315 by 3322.5 and -8122.5 by -8130
E25X&B53X	Clarks Hill(GAX)	3337.5 by 3345 and -8207.5 by -8215
E26X&B27X	Parksville (50mi.)	3345 by 3352.5 and -8207.5 by -8215
E27	Roper's Crossroads	3337.5 by 3345 and -8152.5 by -8200
E28	Salley	3330 by 3337.5 and -8115 by -8122.5
E29	Allendale	3300 by 3307.5 and -8115 by -8122.5
E30	Graniteville	3330 by 3337.5 and -8145 by -8152.5
E31	Oakwood	3330 by 3337.5 and -8130 by -8137.5
E32X	Martinez(GAX)	3330 by 3337.5 and -8200 by -8207.5
E33X	Snellings (SRS)	3307.5 by 3315 and -8122.5 by -8130
E34X&B41X	Gilbert (50mi.)	3352.5 by 3400 and -8122.5 by -8130
E35	Steedman	3345 by 3352.5 and -8122.5 by -8130
E36	Springfield	3322.5 by 3330 and -8115 by -8122.5
E37	Sycamore	3300 by 3307.5 and -8107.5 by -8115
E38X	Brier Creek Island(GAX)	3245 by 3252.5.5 and -8122.5 by -8130
E39X	Bull Pond(GAX)	3252.5 by 3300 and -8122.5 by -8130
E40	Blackville	3315 by 3322.5 and -8115 by -8122.5
E41	Windsor	3322.5 by 3330 and -8130 by -8137.5
E42X&B32X	Saluda South (50mi.)	3352.5 by 3400 and -8145 by -8152.5
E43	Olar	3307.5 by 3315 and -8107.5 by -8115

1. The randomly selected quadrants are from a United States Department of Interior 7.5 Minute Topographic Map Printed by the South Carolina Land Resources Commission, Rv 10/92.
2. "**X**" in any designated ID represents the presence of an **exclusion zone** of either a state border, 50 mi. limit bisector line that splits the quad area into an environmental side and a background side, or occurrence of background random pick area within 10 miles of a nuclear facility.
3. "**E**" means this is a pick selected for SRS perimeter (outside SRS from center point 33 deg. 15' 00" & -81deg. 37' 30"). Public dose outside of SRS and within 10 mi. of a reactor are not excluded for "E" samples.
4. "**B**" means this is a South Carolina background pick outside of the 50 mile limit from SRS center point. Ten mile exclusion zone in "B" quads is used to reduce influence of any local reactor on SC background.

Sampling Location Information

Quadrant locations for South Carolina background random soil samples collected from 2004 - 2007. These locations were randomly selected from a quadrant system established by the U.S. Department of Interior on a 7.5' topographical map of South Carolina revision 10/92.

DOE-SR Environmental Perimeter		Quadrant (Quad) Limits
Random Quadrants Within SRS Perimeter "E"		Inside of the 50-mile SRS Perimeter Zone
Quad	7.5' Quad Name	Latitude by Lat and Longitude by Long
E44	Girard NE	3307.5 by 3315 and -8130 by -8137.5
E45	Gifford	3245 by 3252.5 and -8107.5 by -8115
E46	Cordova	3322.5 by 3330 and -8052.5 by -8100
E47X&B71	Barr Lake	3352.5 by 3400 and -8115 by -8122.5
E48X&B72X	Orangeburg N.(50mi.)	3330 by 3337.5 and -8045 by -8052.5
E49X	Millett (GAX)(NRX)	3300 by 3307.5 and -8030 by -8037.5
E50X&B75X	Batesburg(50mi.)	3352.5 by 3400 and -8130 by -8137.5
E51	Crocketville	3252.5 by 3300 and -8100 by -8107.5
E52X	Girard NW(GAX)	3307.5 by 3315 and -8137.5 and -8145
E53	New Ellenton	3322.5 by 3330 and -8137.5 by -8145
E54X&B80X	Wolfton(50mi.)	3330 by 3337.5 and -8052.5 by -8100
E55	Bamburg	3315 by 3322.5 and -8100 by -8107.5
E56X&B85X	Branchville North(50mi.)	3315 by 3322.5 and -8045 by -8052.5
E57	North Augusta	3330 by 3337.5 and -8152.5 by -8200
E58	Tony Hill Bay	3307.5 by 3315 and -8052.5 by -8100
E59	Williston	3322.5 by 3330 and -8122.5 by -8130
E60X	Shell Bluff Landing(GAX)	3307.5 by 3315 and -8145 by -8152.5
E61	Shirley	3237.5 by 3245 and -8115 by -8122.5
E62	New Ellenton SW	3315 by 3322.5 and -8137.5 by -8145
E63X&B86X	Owdoms(50mi.)	3352.5 by 3400 and -8152.5 by -8200
E64	Martin	3300 by 3307.5 and -8122.5 by -8130
E65	Ridge Spring	3345 by 3352.5 and -8137.5 by -8145
E66X	Blue Springs Landing(GAX)	3237.5 by 3245 and -8122.5 by -8130
E67X&B87X	Pelion East(50mi.)	3345 by 3352.5 and -8107.5 by -8115
E68X	Burtons Ferry Landing(GAX)	3252.5 by 3300 and -8130 by -8137.5
E69	Pond Branch	3337.5 by 3345 and -8107.5 by -8115
E70	Hollow Creek	3322.5 by 3330 and -8145 by -8152.5
E71	Barton	3252.5 by 3300 and -8115 by -8122.5
E72	Aiken NW	3337.5 by 3345 and -8137.5 by -8145
E73X&B88X	Williams(50mi.)	3300 by 3307.5 and -8045 by -8052.5
E74	Fairfax	3252.5 by 3300 and -8107.5 by -9115
E75X&B89X	Hampton(50mi.)	3245 by 3252.5 and -8100 by -8107.5
E76	Lodge	3300 by 3307.5 and -8052.5 by -8100
E77	Solomons Crossroads	3245 by 3252.5 and -8115 by -8122.5
E78X	Augusta East(GAX)	3322.5 by 3330 and -8152.5 by -8200
E79X&B90X	Brighton (50mi.)	3230 by 3237.5 and -8115 by -8122.5
E80X&B91X	Swansea(50mi.)	3337.5 by 3345 and -8100 by -8107.5
E81X&B92X	Cummings (50mi.)	3245 by 3252.5 and -8052.5 by -8100
E82X&B93X	Islandton (50mi.)	3252.5 by 3300 and -8052.5 by -8100
E83X&B94X	Branchville South (50mi.)	3307.5 by 3315 and -8045 by -8052.5
E84	Pelion West	3345 by 3352.5 and -8115 by -8122.5
E85	Johnston	3345 by 3352.5 and -8145 by -8152.5
E86	Wagener	3337.5 by 3345 and -8115 by -8122.5

1. The randomly selected quadrants are from a United States Department of Interior 7.5 Minute Topographic Map Printed by the South Carolina Land Resources Commission, Rv 10/92.
2. "**X**" in any designated ID represents the presence of an **exclusion zone** of either a state border, 50 mi. limit bisector line that splits the quad area into an environmental side and a background side, or occurrence of background random pick area within 10 miles of a nuclear facility.
3. "**E**" means this is a pick selected for SRS perimeter (outside SRS from center point 33 deg. 15' 00" & -81deg. 37' 30"). Public dose outside of SRS and within 10 mi. of a reactor are not excluded for "E" samples.
4. "**B**" means this is a South Carolina background pick outside of the 50 mile limit from SRS center point. Ten mile exclusion zone in "B" quads is used to reduce influence of any local reactor on SC background.

Sampling Location Information

Quadrant locations for South Carolina background random soil samples collected from 2004 - 2007. These locations were randomly selected from a quadrant system established by the U.S. Department of Interior on a 7.5' topographical map of South Carolina revision 10/92.

DOE-SR Environmental Background		Quadrant (Quad) Limits
Random Quadrants for the SC Background "B"		Outside of the 50-mile SRS Perimeter Zone
Quad	7.5' Quad Name	Latitude by Lat and Longitude by Long
B1X	Cashiers (NCX)	3500 by 3507.5 and -8300 by -8307.5
B2X&E1X	Furman (50mi.)	3237.5 by 3245 and -8107.5 by -8115
B3	Felderville	3322.5 by 3330 and -8030 by -8037.5
B4	James Is.	3237.5 by 3245 and -7952.5 by -8000
B5	Carlisle	3430 by 3437.5 and -8122.5 by -8130
B6	Antreville	3415 by 3422.5 and -8230 by -8237.5
B7X	Saluda (NCX)	3507.5 by 3515 and -8215 by -8222.5
B8	Bingham	3422.5 by 3430 and -7930 by -7937.5
B9	Alvin	3315 by 3322.5 and -7945 by -7952.5
B10	Jamestown	3315 by 3322.5 and -7937.5 by -7945
B11	North Is.	3315 by 3322.5 and -7907.5 by -7915
B12	Summerton	3330 by 3337.5 and -8015 by -8022.5
B13	Sharon	3452.5 by 3500 and -8115 by -8122.5
B14X	Lake Murray E (NRX)	3400 by 3407.5 and -8115 by -8122.5
B15	Spring Is.	3215 by 3222.5 and -8045 by -8052.5
B16X	Westminster (NRX)	3437.5 by 3445 and -8300 by -8307.5
B17X	Hartwell Dam (GAX)	3415 by 3422.5 and -8245 by -8252.5
B18X	Hartsville South (NRX)	3415 by 3422.5 and -8000 by -8007.5
B19	Salters	3330 by 3337.5 and -7945 by -7952.5
B20X	Pineland(GAX)	3230 by 3237.5 and -8107.5 by -8115
B21	Mayesville	3352.5 by 3400 and -8007.5 by -8015
B22	Carlisle SE	3430 by 3437.5 and -8115 by -8122.5
B23	Outland	3337.5 by 3345 and -7915 by -7922.5
B24X&E7X	Emory (50mi.)	3352.5 by 3400 and -8137.5 by -8145
B25X&E17X	Orangeburg S. (50mi.)	3322.5 by 3330 and -8045 by -8052.5
B26X&E22X	Grays (50mi.)	3237.5 by 3245 and -8100 by -8107.5
B27X&E26X	Parksville (50mi.)	3345 by 3352.5 and -8207.5 by -8215
B28	Lake City West	3345 by 3352.5 and -7945 by -7952.5
B29	Neyles	3245 by 3252.5 and -8030 by -8037.5
B30	Oak Grove	3415 by 3422.5 and -7930 by -7937.5
B31X	Hardeeville(GAX)	3215 by 3222.5 and -8100 by -8107.5
B32X&E42X	Saluda South (50mi.)	3352.5 by 3400 and -8145 by -8152.5
B33	Bradley	3400 by 3407.5 and -8207.5 by -8215
B34	Greenwood	3407.5 by 3415 and -8207.5 by -8215
B35	Limestone	3352.5.5 by 3400 and -8200 by -8207.5
B36	Abbeville East	3407.5 by 3415 and -8215 by -8222.5
B37	Calhoun Creek	3400 by 3407.5 and -8222.5 by -8230
B38	Laurens North	3430 by 3437.5 and -8200 by -8207.5
B39	Saluda North	3400 by 3407.5 and -8145 by -8152.5
B40	Waterloo	3415 by 3422.5 and -8200 by -8207.5
B41X&E34X	Gilbert (50mi.)	3352.5 by 3400 and -8122.5 by -8130
B42	Reevesville	3307.5 by 3315 and -8037.5 by -8045
B43	Saint Paul	3330 by 3337.5 and -8022.5 by -8030

1. The randomly selected quadrants are from a United States Department of Interior 7.5 Minute Topographic Map Printed by the South Carolina Land Resources Commission, Rv 10/92.
2. "**X**" in any designated ID represents the presence of an **exclusion zone** of either a state border, 50 mi. limit bisector line that splits the quad area into an environmental side and a background side, or occurrence of background random pick area within 10 miles of a nuclear facility.
3. "**E**" means this is a pick selected for SRS perimeter (outside SRS from center point 33 deg. 15' 00" & -81deg. 37' 30"). Public dose outside of SRS and within 10 mi. of a reactor are not excluded for "E" samples.
4. "**B**" means this is a South Carolina background pick outside of the 50 mile limit from SRS center point. Ten mile exclusion zone in "B" quads is used to reduce influence of any local reactor on SC background.

Sampling Location Information

Quadrant locations for South Carolina background random soil samples collected from 2004 - 2007. These locations were randomly selected from a quadrant system established by the U.S. Department of Interior on a 7.5' topographical map of South Carolina revision 10/92.

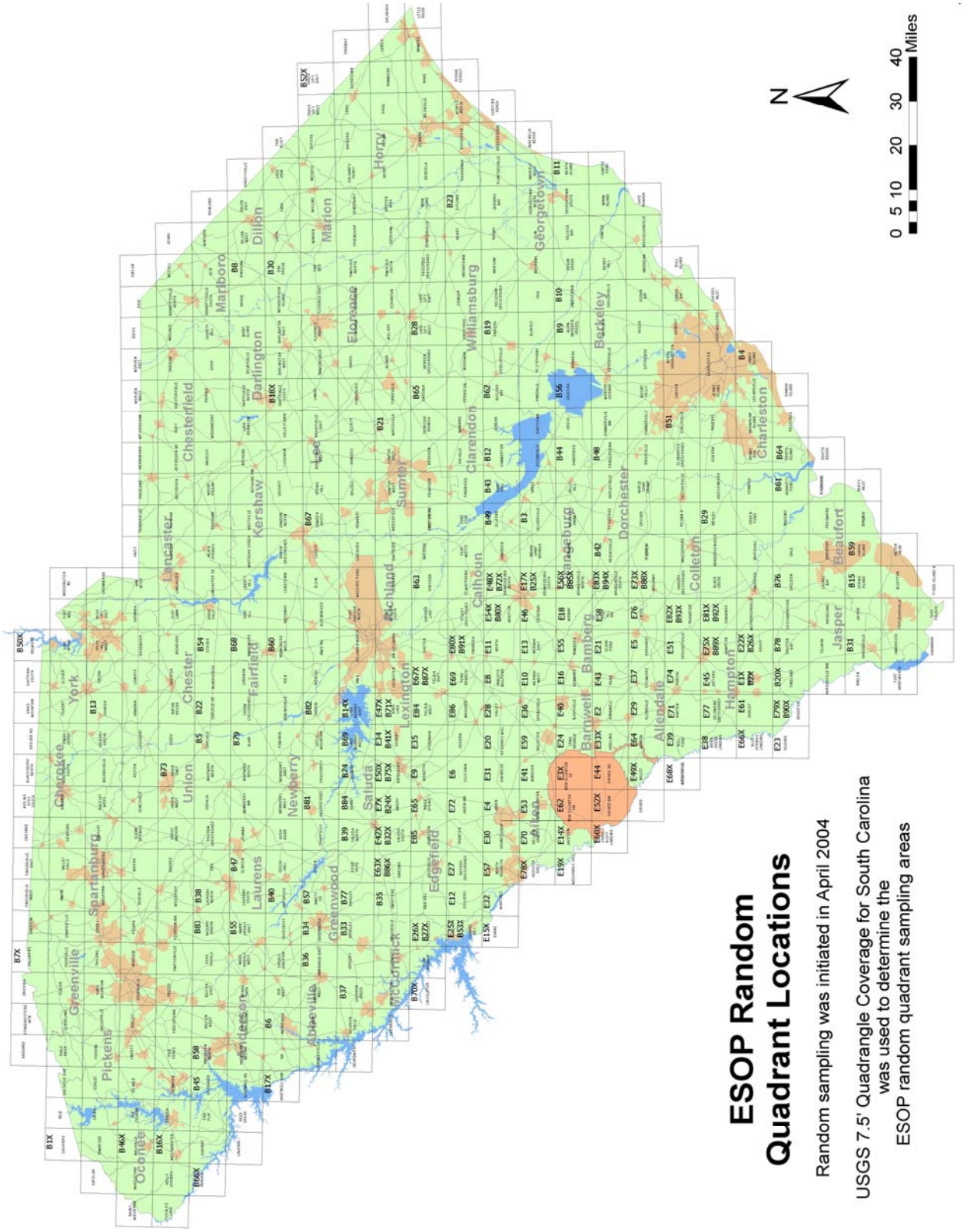
DOE-SR Environmental Background		Quadrant (Quad) Limits
Random Quadrants for the SC Background "B"		Outside of the 50-mile SRS Perimeter Zone
Quad	7.5' Quad Name	Latitude by Lat and Longitude by Long
B44	Sandridge	3315 by 3322.5 and -8015 by -8022.5
B45	La France	3430 by 3437.5 and -8245 by -8252.5
B46X	Walhalla(50mi.)	3445 by 3452.5 and -8300 by -8307.5
B47	Clinton	3422.5 by 3430 and -8152.5 by -8200
B48	Pringletown	3307.5 by 3315 and -8015 by -8022.5
B49	Elloree	3330 by 3337.5 and -8030 by -8037.5
B50X	Belmont(NCX)	3507.5 by 3515 and -8100 by -8107.5
B51	Stallsville	3252.5 by 3300 and -8007.5 by -8015
B52X	Tabor City East(NCX)	3407.5 by 3415 and -7945 by -7952.5
B53X&E25X	Clarks Hill(GAX)	3337.5 by 3345 and -8207.5 by -8215
B54	Stover	3430 by 3437.5 and -8100 by -8107.5
B55	Ware Shoals East	3422.5 by 3430 and -8207.5 by -8015
B56	Chicora	3315 by 3322.5 and -8000 by -8007.5
B57	Ninety Six	3407.5 by 3415 and -8200 by -8207.5
B58	Anderson North	3430 by 3437.5 and -8237.5 by -8245
B59	Parris Island	3215 by 3222.5 and -8037.5 by -8045
B60	Winnsboro Mills	3415 by 3422.5 and -8100 by -8107.5
B61	Bennetts Point	3230 by 3237.5 and -8022.5 by -8030
B62	Butlers Sav	3330 by 3337.5 and -8000 by -8007.5
B63	Gadsden	3345 by 3352.5 and -8045 by -8052.5
B64	Edisto Island	3230 by 3237.5 and -8015 by -8022.5
B65	Sardinia	3345 by 3352.5 and -8000 by -8007.5
B66X	Avalon(GAX)	3430 by 3437.5 and -8307.5 by -8315
B67	Camden South	3407.5 by 3415 and -8030 by -8037.5
B68	Winnsboro	3422.5 by n3430 and -8100 by -8107.5
B69	Lake Murray West	3400 by 3407.5 and -8122.5 by -8130
B70X	Lincolnton(GAX)	3345 by 3352.5 and -8222.5 by -8230
B71X&E47X	Barr Lake (50mi.)	3352.5 by 3400 and -8115 by -8122.5
B72X&E48X	Orangeburg N.(50mi.)	3330 by 3337.5 and -8045 by -8052.5
B73	Union East	3437.5 by 3445 and -8130 by -8137.5
B74	Delmar	3400 by 3407.5 and -8130 by -8137.5
B75X&E50X	Batesburg	3352.5 by 3400 and -8130 by -8137.5
B76	Sheldon	3230 by 3237.5 and -8045 by -8052.5
B77	Kirksey	3400 by 3407.5 and -8200 by -8207.5
B78	Calfpen Bay	3230 by 3237.5 and -8100 by -8107.5
B79	Blair	3422.5 by 3430 and -8122.5 by -8130
B80X&E54X	Wolfton	3330 by 3337.5 and -8052.5 by -8100
B81	Silverstreet	3407.5 by 3415 and -8137.5 by -8145
B82	Chapin	3407.5 by 3415 and -8115 by -8122.5
B83	Hickory Tavern	3430 by 3437.5 and -8207.5 by -8215
B84	Denny	3400 by 3407.5 and -8137.5 by -8145
B85X&E56X	Branchville North	3315 by 3322.5 and -8045 by -8052.5
B86X&E63X	Owdoms	3352.5 by 3400 and -8152.5 by -8200

1. The randomly selected quadrants are from a United States Department of Interior 7.5 Minute Topographic Map Printed by the South Carolina Land Resources Commission, Rv 10/92.
2. "**X**" in any designated ID represents the presence of an **exclusion zone** of either a state border, 50 mi. limit bisector line that splits the quad area into an environmental side and a background side, or occurrence of background random pick area within 10 miles of a nuclear facility.
3. "**E**" means this is a pick selected for SRS perimeter (outside SRS from center point 33 deg. 15' 00" & -81deg. 37' 30"). Public dose outside of SRS and within 10 mi. of a reactor are not excluded for "E" samples.
4. "**B**" means this is a South Carolina background pick outside of the 50 mile limit from SRS center point. Ten mile exclusion zone in "B" quads is used to reduce influence of any local reactor on SC background.

Back to Table of Contents

Sampling Location Information

Map 1. Savannah River Site perimeter and South Carolina background random sampling locations chosen to date. Not all locations have been sampled. **Back to Maps**



1.1 Radiological Atmospheric Monitoring

1.1.1 Summary

Atmospheric transport has the greatest potential to impact the citizens of South Carolina from releases associated with activities at the Savannah River Site (SRS). This project provides independent quantitative monitoring of atmospheric radionuclide releases associated with SRS. It also provides monitoring of atmospheric media on a routine basis to measure radionuclide concentrations in the surrounding environment and to identify trends that may require further investigation. Radiological atmospheric monitoring sites were established to provide spatial coverage of the project area.

The South Carolina Department of Health and Environmental Control (SCDHEC) Environmental Surveillance and Oversight Program (ESOP) air monitoring capabilities in 2007 included nine air-monitoring stations with the capacity for sample collection using glass fiber filters, rain collection pans, silica gel columns, and 19 thermoluminescent dosimeters (TLDs). Five of the air-monitoring stations are on or within two miles of the SRS perimeter, one at the center of the site, two are within 25 miles of the site, and one is a background location. Twelve of the TLDs are on or near the site perimeter, one is in the center of the site, five are within 25 miles of the site and one is a background location. Only perimeter air monitoring stations and TLDs are used in statistical analysis. Refer to map in Section 1.1.2 for specific monitoring locations.

The air station in Beaufort, South Carolina, was put in place so that SCDHEC would have a background monitoring location. This monitoring location is far enough away from SRS so that the samples collected there would not be affected by SRS activities and could be used to compare against samples taken nearer to SRS.

The glass fiber filters were used to collect total suspended particulates (TSP). Particulates were screened weekly for gross alpha and gross beta-emitting activity. Precipitation, when present, was sampled and analyzed monthly for tritium. Silica gel distillates of atmospheric moisture were analyzed monthly for tritium. TLDs were collected and analyzed every quarter for ambient beta/gamma levels. SCDHEC emphasizes monitoring for radionuclides in atmospheric media around the SRS at potential public exposure locations.

SCDHEC data substantiated historically reported Department of Energy-Savannah River (DOE-SR) values for radionuclides in the ambient environment at or near the SRS boundary. Average SCDHEC atmospheric radiological monitoring results for gross alpha/beta in air, tritium in air and rainwater at the SRS boundary are within two standard deviations of the DOE-SR reported average values. Variations in atmospheric radiological monitoring results between SCDHEC and DOE-SR are likely a result of differences in monitoring locations, local meteorological conditions, frequency of sampling, and number of locations.

In summary no United States Environmental Protection Agency (USEPA) air standards were exceeded at the monitored locations and there were no elevations of radiological pollutant concentrations associated with SRS operations. Sampling results by SCDHEC indicate that SRS activities had a measurable but negligible impact on local air quality.

RESULTS AND DISCUSSION

Total Suspended Particulates (TSP)

Routine weekly data for TSP can be found in section 1.1.4.

Gross Alpha

During the 2007 sampling period, gross alpha activity ranged from 0.006 to 0.0690 picoCuries per cubic meter (pCi/m^3) at the site perimeter. The maximum came on November 6, 2007 in New Ellenton, South Carolina. Values in this range are typically associated with naturally occurring alpha-emitting radionuclides, primarily as decay products of radon (Kathren 1984), and are considered normal. If gross alpha counts are above the range of 0.7 pCi/m^3, which is the action level according to Rhonda Sears of the USEPA, the filters are analyzed for specific radioisotopes (Sears 2005). The SCDHEC average gross alpha radionuclide concentration in 2007 was 0.0038 (± 0.0048) pCi/m^3. The DOE-SR gross alpha average of 0.0012 (± 0.0004) pCi/m^3 is within one standard deviation of the SCDHEC gross alpha activity average (WSRC 2008a).

Gross Beta

During the 2007 sampling period, the site perimeter gross beta concentrations ranged from 0.0010 to 0.0902 pCi/m^3. The maximum occurred on December 11, 2007 at the Allendale Barricade (ABR) air station. Values in this range are typically associated with naturally occurring beta-emitting radionuclides, primarily as decay products of radon (Kathren 1984). Small seasonal variations at each monitoring location have been consistent with historically reported SCDHEC values (SCDHEC 2007a). The USEPA, Office of Radiation and Indoor Air, uses gross beta counts as an indicator to determine if additional analyses will be performed. A gamma scan is conducted if the gross beta activity exceeds 1 pCi/m^3. This is the tiering of definitive analyses that is used for all total suspended particulate sampling associated with RadNet. RadNet is comprised of a nationwide network of sampling stations that identify trends in the accumulation of long-lived radionuclides in the environment (USEPA 2005). Over the past six years, SCDHEC has seen a slight increase in gross beta while DOE-SR activities have remained stable. Figure 1 shows average gross beta activity for SRS perimeter locations and illustrates trending of gross beta values for SCDHEC and DOE-SR. The average gross beta concentration reported by SCDHEC in 2007 was 0.0238 (± 0.0119) pCi/m^3. The DOE-SR gross beta average of 0.0163 (± 0.0037) pCi/m^3 is within one standard deviation of the SCDHEC gross beta activity average (WSRC 2008a).

Ambient Beta/Gamma

SCDHEC conducts ambient beta/gamma monitoring through the deployment of TLDs around the perimeter of the SRS. Ambient beta/gamma levels measured with TLDs are provided for all quarters of 2007. It should be noted that 4 mrem are subtracted from the reported result for each TLD to account for the transcontinental flight from South Carolina to California and back (Walter 1995). The SCDHEC average ambient beta/gamma activity in 2007 was 98 (± 6) mrem. The DOE-SR average ambient beta/gamma activity was 77 (± 12) mrem for 2007. The DOE-SR ambient/beta gamma average was within two standard deviations of the SCDHEC average. During the sampling period, SCDHEC external radiation levels at monitored locations were higher than levels reported by DOE-SR. Over the past six years, there have been no major

increases or decreases in the average ambient beta/gamma activity reported by DOE-SR or SCDHEC. Figure 2 shows trends at the SRS perimeter for averaged ambient beta/gamma values for DOE-SR and SCDHEC.

Tritium

Tritium continues to be the predominant radionuclide detected above background in the perimeter samples. During 2007, DOE-SR released approximately 30,800 Ci of tritium from SRS (WSRC 2008a). Most of tritium detected in the SCDHEC perimeter samples may be attributed to the release of tritium from reactor stacks, separation areas, and from diffuse and fugitive sources (WSRC 2008a).

Tritium In Air

Tritium in air values reported by SCDHEC are the result of using the historical means of calculating an air concentration of tritium based on the upper limit value of absolute humidity in the region of 11.5 grams of atmospheric moisture per cubic meter (NCRP 1984). SCDHEC tritium results greater than the Lower Limit of Detection (LLD) are converted from picocuries per liter (pCi/L) to pCi/m^3. Average SCDHEC tritium in air activity was consistently lower than the DOE-SR measured activity although well within the same order-of-magnitude.

Average tritium in air activity at the SRS perimeter reported by SCDHEC for 2007 was the same as reported in 2006 and has fluctuated higher and lower over the last six years. DOE-SR reported a decrease from 2006 to 2007, with a decrease over all of the last six years. For the past two years the SCDHEC and DOE-SR measured and calculated averages have been approximately the same. Figure 3 illustrates trending of atmospheric tritium activity for SCDHEC and DOE-SR as measured and calculated at the SRS perimeter.

The DOE-SR average measured value for tritium activity in air at the SRS boundary was 6.05 (± 5.89) pCi/m^3 (WSRC 2008a). The SCDHEC average measured activity for tritium was 5.16 (± 1.45) pCi/m^3. The maximum tritium in air activity of 8.08 pCi/m^3 was collected on March 27, 2007 at the South Carolina Advanced Technology Park located in Snelling, South Carolina. The SCDHEC average for tritium activity was well below the USEPA equivalent standard of 21,000 pCi/m^3 for airborne tritium activity (ANL 2007). DOE-SR average measured values for tritium in atmospheric moisture were higher than SCDHEC averaged measured values for the SRS perimeter (WSRC 2008a). The SCDHEC average measured activity for tritium was within one standard deviation of the DOE-SR measured average. This difference may be attributed to a dilution that occurs when desiccants are used for collecting atmospheric moisture for tritium analysis. Tritium concentrations in air, as determined using desiccants, can result in under-reporting of air tritium concentrations by factors of 1.4 to 2.6 (Rosson 2000). Prior to deployment in the field, silica-gel desiccant is dried to remove any moisture. However, a small percentage of water remains in the desiccant. This results in a slight dilution of the collected sample, which is reflected in the distillate. DOE-SR has implemented a correction factor for tritium-in-air measurements using silica-gel (WSRC 2008a). Another factor that may contribute to the lower SCDHEC air tritium values is that only two of the monitoring stations are exactly on the SRS perimeter (property line), while the other three points used for this comparison are located approximately two miles from the SRS property line.

Tritium In Rainwater

The DOE-SR average measured value for tritium activity in rainwater at the SRS perimeter was 120.36 (± 216.45) pCi/L (WSRC 2008a). The SCDHEC measured activity for tritium in rainwater was 307.05 (± 84.36) pCi/L. The SCDHEC and DOE-SR averages for tritium activity were well below the EPA standard of 20,000 pCi/L in drinking water (USEPA 2002a). The DOE-SR averages for tritium activity were within one standard deviation of the SCDHEC average.
The maximum reported value for SCDHEC perimeter locations was 471 (± 101) pCi/L, collected at the South Carolina Advanced Technology Park located in Snelling, South Carolina, on May 29, 2007.

CONCLUSIONS AND RECOMMENDATIONS

All SCDHEC data collected in 2007 confirmed historically reported DOE-SR values for gross alpha/beta, ambient beta/gamma and tritium in the environment at the SRS boundary with no anomalous data noted for any monitored parameters.

Due to the variability of environmental data and the frequency of collecting samples, SCDHEC air and tritium data averages were within two standard deviations of DOE-SR measured averages. SCDHEC tritium in air and rainwater data was consistently within the same order of magnitude as the DOE-SR measured values.

The background location in Beaufort, South Carolina, had no detections of tritium in air or rainwater. The future of this station is uncertain; it will likely be removed in 2008 because the data that is collected at the Aiken and Allendale locations provide background data.

No EPA air standards were exceeded at the monitored locations and there were no elevations of radiological pollutant concentrations associated with SRS operations. Sampling results by SCDHEC indicate that SRS activities did have a measurable but negligible impact on local air quality.

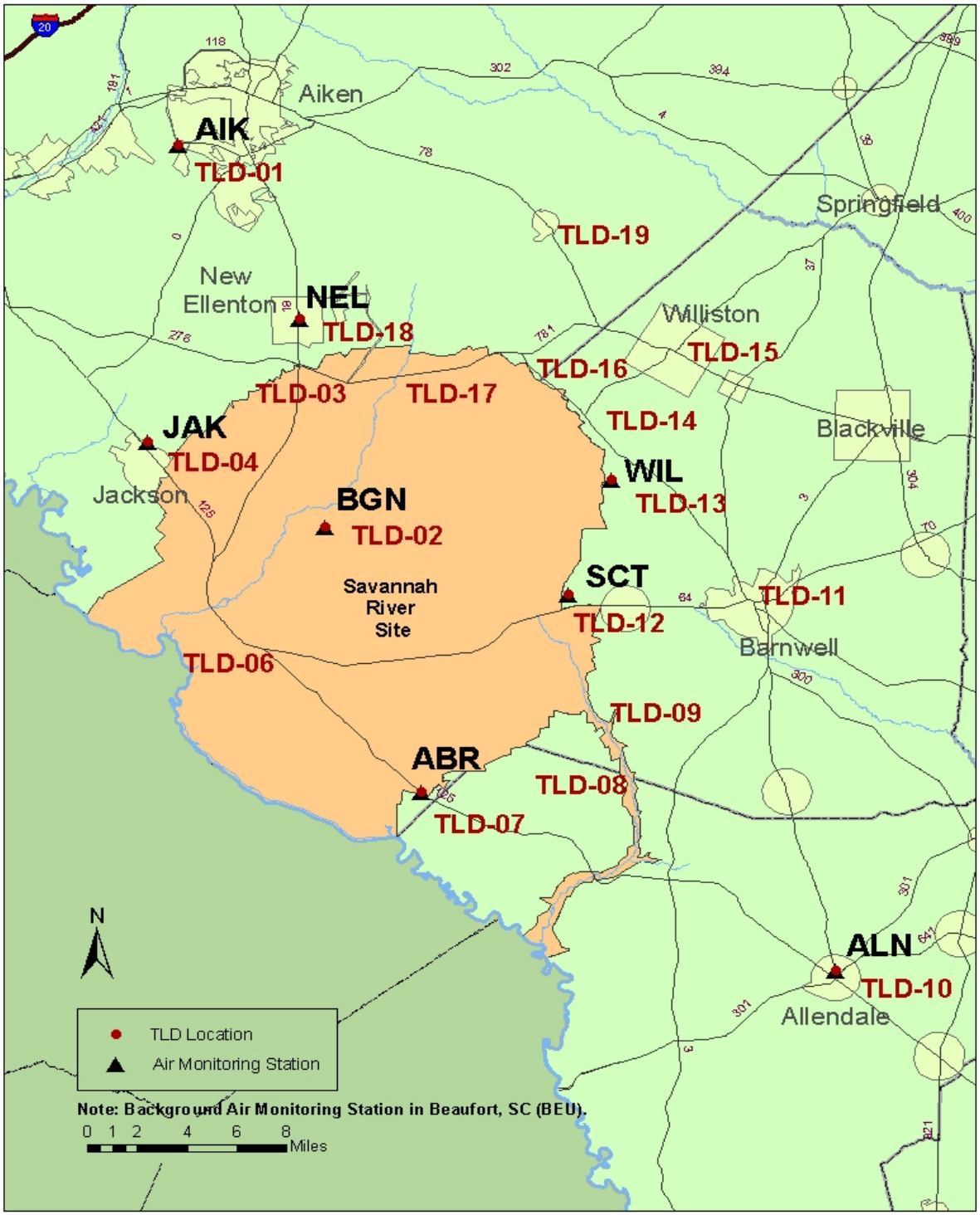
SCDHEC will continue to collect weekly gross alpha/beta, monthly tritium, and quarterly ambient beta/gamma samples.

Back to Table of Contents

1.1.2

Map 2. Radiological Atmospheric Monitoring Locations

Back to Maps



1.1.3 Tables and Figures

Back to Tables and Figures

Radiological Monitoring of Air

Figure 1. Average Gross Beta for Total Suspended Particulates at the SRS Perimeter.

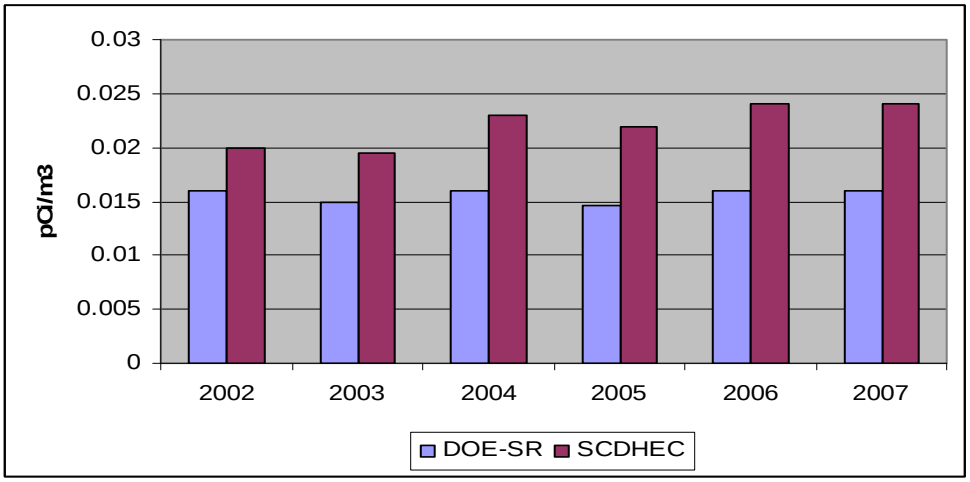


Figure 2. Average Ambient Beta/Gamma at the SRS Perimeter.

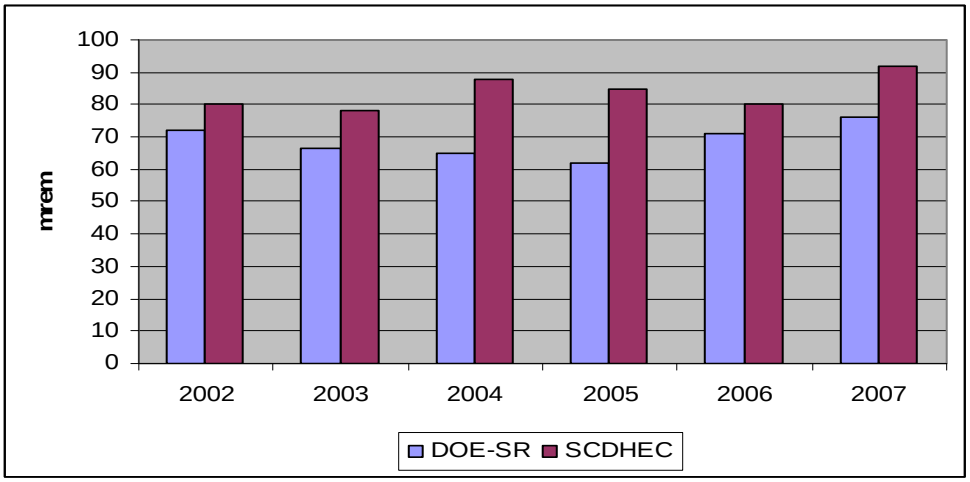
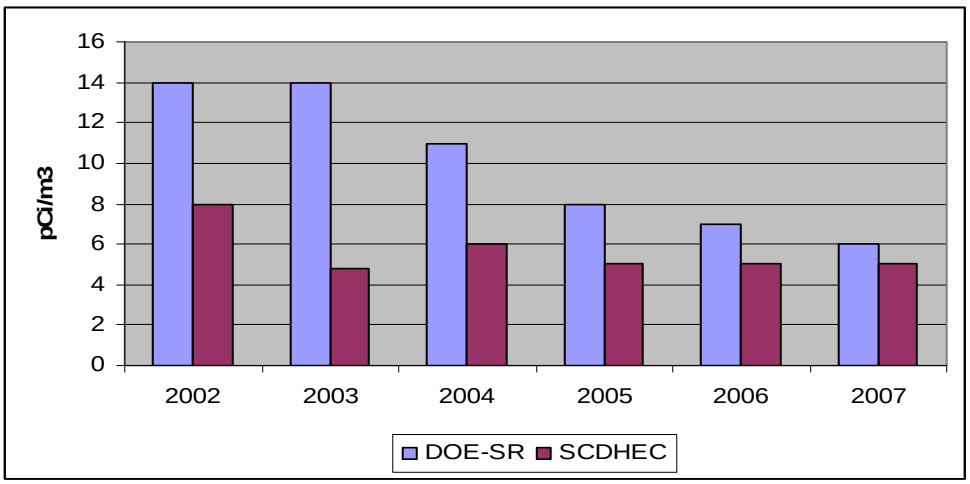


Figure 3. Average Tritium in Air at the SRS Perimeter.



1.1.4 Data

Radiological Atmospheric Monitoring

Quarterly TLD Beta/Gamma Data 8

Air Station Data 9

Notes:

1. NS -- No Sample
2. N/A -- Not Applicable
3. LLD -- Lower Limit of Detection
4. < -- Less Than LLD

Back to List of Data Tables

Quarterly TLD Beta/Gamma Data Summary, 2007

Sample Location	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Year	Year - 16mrem (for cross country flight)
	mrem	mrem	mrem	mrem	mrem	mrem
Collocated with Aiken Air Station	23.00	24.00	21.00	26.00	94.00	78.00
E Area	37.00	37.00	37.00	39.00	150.00	134.00
Green Pond	30.00	25.00	29.00	31.00	115.00	99.00
Collocated with Jackson Air Station	25.00	27.00	25.00	26.00	103.00	87.00
Crackerneck Gate	27.00	32.00	27.00	33.00	119.00	103.00
TNX Boat Ramp	31.00	25.00	31.00	34.00	121.00	105.00
Collocated with Allendale Barricade	23.00	29.00	27.00	29.00	108.00	92.00
Junction of Millet Road and Round Tree Road	29.00	30.00	28.00	34.00	121.00	105.00
Patterson Mill Road at Lower Three Runs	30.00	26.00	31.00	35.00	122.00	106.00
Collocated with Allendale Air station	26.00	25.00	25.00	27.00	103.00	87.00
Barnwell Airport	26.00	31.00	27.00	29.00	113.00	97.00
Collocated with Snelling Air station	25.00	28.00	28.00	34.00	115.00	99.00
Collocated with Williston Air station	26.00	24.00	26.00	30.00	106.00	90.00
Bates Cemetery	25.00	29.00	27.00	31.00	112.00	96.00
Williston Police Department	30.00	27.00	30.00	32.00	119.00	103.00
Junction of US 278 and SC 781	27.00	32.00	28.00	32.00	119.00	103.00
US 278 near Upper Three Runs	31.00	27.00	33.00	28.00	119.00	103.00
Collocated with New Ellenton Air Station	27.00	29.00	26.00	30.00	112.00	96.00
Windsor Post Office	28.00	27.00	28.00	30.00	113.00	97.00
Beaufort	29.00	28.00	28.00	30.00	115.00	99.00

Routine Radiological Atmospheric Monitoring Data, 2007

Sample Location:	Aiken Elementary Water Tower (AIK)							
Date	Gross Alpha in Air		Gross Beta in Air		Tritium in Air		Tritium in Rain	
	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/L	+- 2 sigma
01/02/07	0.0021	0.0008	0.0176	0.0017				
01/09/07	0.0021	0.0007	0.0164	0.0015				
01/16/07	0.0033	0.0009	0.0131	0.0015				
01/24/07	0.0028	0.0008	0.0195	0.0016				
01/30/07	0.0027	0.0010	0.0222	0.0019	3.89	1.08	<190	N/A
02/06/07	0.0022	0.0008	0.0278	0.0019				
02/13/07	0.0042	0.0009	0.0263	0.0019				
02/20/07	0.0032	0.0008	0.0240	0.0018				
02/27/07	0.0024	0.0008	0.0224	0.0018	4.13	1.16	<198	N/A
03/06/07	0.0024	0.0007	0.0222	0.0017				
03/13/07	0.0025	0.0007	0.0165	0.0016				
03/20/07	0.0019	0.0007	0.0150	0.0015				
03/27/07	0.0024	0.0008	0.0168	0.0016	<2.25	N/A	<196	N/A
04/03/07	0.0026	0.0008	0.0209	0.0018				
04/10/07	0.0029	0.0009	0.0205	0.0017				
04/17/07	0.0033	0.0009	0.0216	0.0018				
04/24/07	0.0019	0.0008	0.0158	0.0016	<2.24	N/A	<195	N/A
05/01/07	0.0025	0.0008	0.0202	0.0017				
05/08/07	0.0030	0.0023	0.0359	0.0023				
05/14/07	0.0062	0.0011	0.0162	0.0016				
05/22/07	0.0025	0.0007	0.0208	0.0016				
05/29/07	0.0029	0.0008	0.0242	0.0018	<2.22	N/A	<193	N/A
06/05/07	0.0040	0.0009	0.0328	0.0021				
06/11/07	0.0031	0.0009	0.0252	0.0020				
06/19/07	0.0023	0.0007	0.0221	0.0017				
06/26/07	0.0023	0.0008	0.0273	0.0019	<2.32	N/A	<202	N/A
07/03/07	0.0025	0.0008	0.0187	0.0017				
07/11/07	0.0028	0.0007	0.0243	0.0018				
07/18/07	0.0035	0.0009	0.0202	0.0017				
07/24/07	0.0021	0.0007	0.0150	0.0014	<2.19	N/A	<190	N/A
07/31/07	0.0023	0.0007	0.0189	0.0017				
08/07/07	0.0027	0.0008	0.0264	0.0019				
08/14/07	0.0032	0.0009	0.0314	0.0021				
08/21/07	0.0045	0.0010	0.0337	0.0021				
08/28/07	0.0013	0.0007	0.0123	0.0014	<2.25	N/A	<196	N/A
09/04/07	0.0030	0.0008	0.0235	0.0018				
09/11/07	0.0022	0.0008	0.0252	0.0020				
09/18/07	0.0030	0.0009	0.0148	0.0016				
09/25/07	0.0026	0.0009	0.0168	0.0017	<2.25	N/A	<196	N/A
10/02/07	0.0064	0.0012	0.0259	0.0020				
10/09/07	0.0033	0.0009	0.0134	0.0016				
10/16/07	0.0063	0.0012	0.0245	0.0020				
10/23/07	0.0035	0.0009	0.0266	0.0019				
10/30/07	0.0033	0.0009	0.0188	0.0018	<2.33	N/A	<203	N/A
11/06/07	0.0029	0.0009	0.0277	0.0021				
11/13/07	0.0051	0.0011	0.0407	0.0024				
11/20/07	0.0045	0.0010	0.0276	0.0020				
11/27/07	0.0021	0.0008	0.0241	0.0020	<2.19	N/A	<190	N/A
12/04/07	0.0187	0.0019	0.0286	0.0021				
12/11/07	0.0071	0.0013	0.0467	0.0025				
12/20/07	0.0140	0.0015	0.0658	0.0027				
12/27/07	0.0085	0.0014	0.0475	0.0026	4.83	1.16	224	91

Routine Radiological Atmospheric Monitoring Data, 2007

Sample Location:	New Ellenton, SC (NEL)							
Date	**Gross Alpha in Air**		**Gross Beta in Air**		**Tritium in Air**		**Tritium in Rain**	
	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/L	+- 2 sigma
01/02/07	0.0031	0.0009	0.0255	0.0022				
01/09/07	0.0021	0.0007	0.0177	0.0017				
01/16/07	NS	N/A	NS	N/A				
01/24/07	0.0030	0.0008	0.0214	0.0017				
01/30/07	0.0032	0.0011	0.0308	0.0023	6.53	1.19	207	89
02/06/07	0.0028	0.0009	0.0269	0.0019				
02/13/07	0.0043	0.0009	0.0302	0.0020				
02/20/07	0.0026	0.0007	0.0222	0.0018				
02/27/07	0.0024	0.0008	0.0200	0.0017	4.61	1.12	223	93
03/06/07	0.0024	0.0008	0.0240	0.0018				
03/13/07	0.0032	0.0009	0.0227	0.0019				
03/20/07	0.0036	0.0010	0.0208	0.0018				
03/27/07	0.0029	0.0009	0.0259	0.0020	5.54	1.10	<196	N/A
04/03/07	0.0033	0.0010	0.0222	0.0019				
04/10/07	0.0038	0.0010	0.0259	0.0021				
04/17/07	0.0033	0.0009	0.0250	0.0019				
04/24/07	0.0023	0.0008	0.0171	0.0017	6.04	1.19	<195	N/A
05/01/07	0.0027	0.0009	0.0223	0.0019				
05/08/07	0.0026	0.0009	0.0179	0.0017				
05/14/07	0.0020	0.0008	0.0167	0.0019				
05/22/07	0.0029	0.0008	0.0250	0.0019				
05/29/07	0.0034	0.0009	0.0254	0.0020	5.85	1.18	<193	N/A
06/05/07	0.0026	0.0008	0.0186	0.0019				
06/11/07	0.0021	0.0008	0.0188	0.0017				
06/19/07	0.0026	0.0009	0.0255	0.0020				
06/26/07	0.0022	0.0008	0.0265	0.0019	4.43	1.16	<202	N/A
07/03/07	0.0025	0.0008	0.0190	0.0019				
07/11/07	0.0027	0.0008	0.0228	0.0019				
07/18/07	0.0034	0.0009	0.0213	0.0018				
07/24/07	0.0023	0.0008	0.0148	0.0015	6.43	1.18	268	91
07/31/07	0.0020	0.0008	0.0217	0.0019				
08/07/07	0.0031	0.0009	0.0317	0.0022				
08/14/07	<0.000995	N/A	0.0179	0.0010				
08/21/07	0.0033	0.0010	0.0356	0.0023				
08/28/07	0.0021	0.0008	0.0155	0.0017	4.62	1.14	<196	N/A
09/04/07	0.0032	0.0009	0.0222	0.0019				
09/11/07	0.0025	0.0008	0.0223	0.0018				
09/18/07	0.0030	0.0011	0.0169	0.0020				
09/25/07	0.0036	0.0011	0.0225	0.0021	5.78	1.18	<196	N/A
10/02/07	0.0060	0.0013	0.0298	0.0024				
10/09/07	0.0028	0.0010	0.0149	0.0018				
10/16/07	0.0070	0.0014	0.0349	0.0026				
10/23/07	0.0038	0.0010	0.0329	0.0021				
10/30/07	0.0023	0.0009	0.0155	0.0018	5.88	1.22	<203	N/A
11/06/07	0.0690	0.0014	0.0053	0.0030				
11/13/07	0.0077	0.0014	0.0637	0.0033				
11/20/07	0.0047	0.0012	0.0394	0.0027				
11/27/07	0.0041	0.0012	0.0339	0.0026	5.78	1.17	<190	N/A
12/04/07	0.0217	0.0021	0.0391	0.0024				
12/11/07	0.0092	0.0014	0.0637	0.0030				
12/20/07	0.0034	0.0009	0.0163	0.0016				
12/27/07	0.0088	0.0015	0.0595	0.0032	5.30	1.12	398	96

Routine Radiological Atmospheric Monitoring Data, 2007

Sample Location:	**Jackson, SC (JAK)**							
Date	**Gross Alpha in Air**		**Gross Beta in Air**		**Tritium in Air**		**Tritium in Rain**	
	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/L	+- 2 sigma
01/02/07	0.0028	0.0009	0.0236	0.0021				
01/09/07	0.0022	0.0008	0.0182	0.0017				
01/16/07	0.0021	0.0008	0.0130	0.0015				
01/24/07	0.0028	0.0008	0.0213	0.0017				
01/30/07	0.0034	0.0010	0.0273	0.0021	5.04	1.13	195	89
02/06/07	0.0030	0.0010	0.0295	0.0021				
02/13/07	0.0035	0.0009	0.0310	0.0022				
02/20/07	0.0036	0.0009	0.0267	0.0020				
02/27/07	0.0025	0.0008	0.0191	0.0018	3.75	1.12	271	95
03/06/07	0.0028	0.0008	0.0247	0.0019				
03/13/07	0.0034	0.0009	0.0253	0.0021				
03/20/07	0.0040	0.0011	0.0220	0.0020				
03/27/07	0.0032	0.0009	0.0211	0.0018	4.88	1.21	254	97
04/03/07	0.0026	0.0009	0.0215	0.0018				
04/10/07	0.0026	0.0009	0.0265	0.0020				
04/17/07	0.0035	0.0010	0.0215	0.0019				
04/24/07	0.0025	0.0009	0.0172	0.0017	6.26	1.21	<195	N/A
05/01/07	0.0026	0.0009	0.0210	0.0018				
05/08/07	0.0033	0.0010	0.0224	0.0019				
05/14/07	0.0025	0.0009	0.0141	0.0018				
05/22/07	0.0026	0.0008	0.0245	0.0019				
05/29/07	0.0027	0.0008	0.0300	0.0022	5.97	1.18	<193	N/A
06/05/07	0.0043	0.0010	0.0319	0.0022				
06/11/07	0.0029	0.0009	0.0225	0.0021				
06/19/07	0.0026	0.0009	0.0222	0.0018				
06/26/07	0.0029	0.0009	0.0272	0.0019	6.50	1.24	<202	N/A
07/03/07	0.0019	0.0007	0.0116	0.0015				
07/11/07	0.0022	0.0007	0.0269	0.0020				
07/18/07	0.0034	0.0009	0.0200	0.0018				
07/24/07	0.0016	0.0007	0.0015	0.0015	7.03	1.21	214	89
07/31/07	0.0023	0.0008	0.0183	0.0017				
08/07/07	0.0032	0.0009	0.0304	0.0022				
08/14/07	0.0033	0.0009	0.0368	0.0024				
08/21/07	0.0030	0.0010	0.0317	0.0023				
08/28/07	0.0014	0.0008	0.0176	0.0018	4.17	1.13	308	95
09/04/07	0.0040	0.0010	0.0311	0.0021				
09/11/07	0.0027	0.0009	0.0251	0.0021				
09/18/07	0.0027	0.0010	0.0148	0.0019				
09/25/07	0.0039	0.0011	0.0217	0.0021	6.04	1.19	<196	N/A
10/02/07	0.0063	0.0013	0.0261	0.0022				
10/09/07	0.0029	0.0010	0.0113	0.0016				
10/16/07	0.0080	0.0015	0.0328	0.0025				
10/23/07	0.0038	0.0010	0.0300	0.0021				
10/30/07	0.0030	0.0010	0.0200	0.0021	4.77	1.17	<203	N/A
11/06/07	0.0059	0.0013	0.0472	0.0029				
11/13/07	0.0074	0.0014	0.0609	0.0032				
11/20/07	0.0051	0.0013	0.0351	0.0026				
11/27/07	0.0028	0.0010	0.0297	0.0024	7.00	1.21	229	90
12/04/07	0.0021	0.0023	0.0322	0.0025				
12/11/07	0.0104	0.0016	0.0712	0.0033				
12/20/07	0.0023	0.0008	0.0156	0.0015				
12/27/07	0.0093	0.0016	0.0575	0.0032	3.58	1.07	399	95

Routine Radiological Atmospheric Monitoring Data, 2007

Sample Location:	Burial Grounds North (BGN)							
Date	**Gross Alpha in Air**		**Gross Beta in Air**		**Tritium in Air**		**Tritium in Rain**	
	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/L	+- 2 sigma
01/02/07	0.0031	0.0010	0.0236	0.0021				
01/09/07	0.0020	0.0007	0.0170	0.0017				
01/16/07	0.0020	0.0008	0.0133	0.0016				
01/24/07	0.0029	0.0008	0.0176	0.0016				
01/30/07	0.0034	0.0011	0.0279	0.0023	199	4.53	2814	169
02/06/07	0.0030	0.0010	0.0267	0.0021				
02/13/07	0.0044	0.0010	0.0310	0.0022				
02/20/07	0.0031	0.0008	0.0240	0.0020				
02/27/07	0.0095	0.0014	0.0315	0.0022	185	4.38	2565	167
03/06/07	0.0068	0.0012	0.0243	0.0020				
03/13/07	0.0031	0.0009	0.0253	0.0021				
03/20/07	0.0025	0.0009	0.0197	0.0019				
03/27/07	0.0027	0.0009	0.0250	0.0019	232	4.78	4289	197
04/03/07	0.0021	0.0008	0.0204	0.0018				
04/10/07	0.0031	0.0009	0.0251	0.0020				
04/17/07	0.0027	0.0009	0.0221	0.0019				
04/24/07	0.0024	0.0009	0.0212	0.0019	245	4.80	4229	200
05/01/07	0.0023	0.0009	0.0177	0.0017				
05/08/07	0.0023	0.0009	0.0289	0.0021				
05/14/07	0.0022	0.0009	0.0127	0.0018				
05/22/07	0.0030	0.0008	0.0255	0.0020				
05/29/07	0.0032	0.0009	0.0254	0.0021	240	4.74	3913	193
06/05/07	0.0041	0.0010	0.0295	0.0022				
06/11/07	0.0030	0.0009	0.0208	0.0021				
06/19/07	0.0018	0.0008	0.0203	0.0018				
06/26/07	0.0023	0.0008	0.0230	0.0019	235	4.74	3956	195
07/03/07	0.0018	0.0007	0.0120	0.0016				
07/11/07	0.0023	0.0007	0.0215	0.0018				
07/18/07	0.0028	0.0009	0.0178	0.0017				
07/24/07	0.0021	0.0007	0.0135	0.0014	250	4.66	4236	196
07/31/07	0.0017	0.0007	0.0176	0.0017				
08/07/07	0.0029	0.0009	0.0275	0.0020				
08/14/07	0.0024	0.0009	0.0335	0.0023				
08/21/07	0.0035	0.0010	0.0277	0.0021				
08/28/07	0.0021	0.0008	0.0132	0.0016	229	4.63	3968	193
09/04/07	0.0040	0.0009	0.0335	0.0021				
09/11/07	0.0017	0.0008	0.0192	0.0018				
09/18/07	0.0030	0.0011	0.0146	0.0019				
09/25/07	0.0036	0.0011	0.0222	0.0021	231	4.66	3784	190
10/02/07	0.0064	0.0014	0.0286	0.0024				
10/09/07	0.0027	0.0010	0.0138	0.0018				
10/16/07	0.0057	0.0013	0.0315	0.0025				
10/23/07	0.0028	0.0009	0.0308	0.0022				
10/30/07	0.0030	0.0010	0.0156	0.0018	227	4.62	3825	193
11/06/07	0.0049	0.0012	0.0420	0.0027				
11/13/07	0.0067	0.0013	0.0504	0.0029				
11/20/07	0.0042	0.0012	0.0309	0.0024				
11/27/07	0.0030	0.0011	0.0231	0.0022	229	4.63	3937	193
12/04/07	0.0192	0.0022	0.0322	0.0025				
12/11/07	0.0097	0.0017	0.0722	0.0035				
12/20/07	0.0031	0.0008	0.0134	0.0014				
12/27/07	0.0080	0.0015	0.0474	0.0028	187	4.04	4236	198

Routine Radiological Atmospheric Monitoring Data, 2007

Sample Location:	Allendale Barricade (ABR)							
Date	**Gross Alpha in Air**		**Gross Beta in Air**		**Tritium in Air**		**Tritium in Rain**	
	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/L	+- 2 sigma
01/02/07	0.0033	0.0009	0.0197	0.0019				
01/09/07	0.0014	0.0006	0.0144	0.0015				
01/16/07	0.0011	0.0007	0.0052	0.0012				
01/24/07	0.0025	0.0008	0.0184	0.0016				
01/30/07	0.0029	0.0011	0.0237	0.0022	4.96	1.13	376	97
02/06/07	0.0013	0.0008	0.0137	0.0016				
02/13/07	0.0009	0.0005	0.0154	0.0009				
02/20/07	0.0020	0.0007	0.0197	0.0018				
02/27/07	0.0018	0.0007	0.0172	0.0017	3.15	1.05	243	94
03/06/07	<0.001	N/A	0.0198	0.0009				
03/13/07	0.0021	0.0008	0.0149	0.0017				
03/20/07	0.0018	0.0009	0.0115	0.0016				
03/27/07	0.0012	0.0009	0.0101	0.0017	<2.25	N/A	311	98
04/03/07	0.0013	0.0008	0.0061	0.0013				
04/10/07	0.0020	0.0008	0.0187	0.0018				
04/17/07	0.0028	0.0011	0.0176	0.0020				
04/24/07	0.0013	0.0008	0.0115	0.0017	2.24	1.04	351	98
05/01/07	0.0030	0.0010	0.0020	0.0018				
05/08/07	0.0007	0.0006	0.0074	0.0012				
05/14/07	0.0013	0.0007	0.0086	0.0016				
05/22/07	0.0011	0.0006	0.0068	0.0012				
05/29/07	0.0028	0.0008	0.0214	0.0019	<2.22	N/A	264	94
06/05/07	0.0018	0.0007	0.0115	0.0015				
06/11/07	0.0006	0.0006	0.0052	0.0013				
06/19/07	<.00101	N/A	0.0088	0.0013				
06/26/07	0.0019	0.0008	0.0172	0.0016	2.76	1.09	<202	N/A
07/03/07	0.0012	0.0006	0.0059	0.0012				
07/11/07	0.0018	0.0007	0.0105	0.0014				
07/18/07	0.0013	0.0007	0.0086	0.0013				
07/24/07	0.0007	0.0005	0.0487	0.0010	2.92	1.06	379	98
07/31/07	0.0021	0.0008	0.0176	0.0017				
08/07/07	0.0017	0.0007	0.0163	0.0016				
08/14/07	<0.00105	N/A	0.0110	0.0015				
08/21/07	<0.00109	N/A	0.0250	0.0011				
08/28/07	<0.00111	N/A	0.0135	0.0016	2.81	1.07	204	91
09/04/07	0.0038	0.0009	0.0363	0.0022				
09/11/07	0.0024	0.0008	0.0264	0.0021				
09/18/07	0.0034	0.0009	0.0147	0.0020				
09/25/07	0.0033	0.0012	0.0062	0.0015	2.89	1.07	215	93
10/02/07	0.0057	0.0013	0.0289	0.0024				
10/09/07	0.0034	0.0011	0.0122	0.0017				
10/16/07	0.0066	0.0014	0.0328	0.0025				
10/23/07	0.0035	0.0010	0.0270	0.0020				
10/30/07	0.0041	0.0011	0.0208	0.0021	<2.33	N/A	209	96
11/06/07	0.0095	0.0016	0.0571	0.0032				
11/13/07	0.0108	0.0017	0.0214	0.0021				
11/20/07	0.0014	0.0019	0.0219	0.0022				
11/27/07	0.0046	0.0012	0.0360	0.0026	3.46	1.07	341	97
12/04/07	0.0100	0.0017	0.0202	0.0021				
12/11/07	0.0120	0.0018	0.0902	0.0038				
12/20/07	0.0039	0.0009	0.0228	0.0018				
12/27/07	0.0104	0.0016	0.0619	0.0034	5.81	1.20	431	99

Routine Radiological Atmospheric Monitoring Data, 2007

Sample Location:	Allendale, SC (ALN)							
Date	**Gross Alpha in Air**		**Gross Beta in Air**		**Tritium in Air**		**Tritium in Rain**	
	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/L	+- 2 sigma
01/02/07	0.0029	0.0009	0.0224	0.0020				
01/09/07	0.0026	0.0008	0.0175	0.0016				
01/16/07	0.0025	0.0008	0.0147	0.0016				
01/24/07	0.0026	0.0008	0.0191	0.0017				
01/30/07	0.0033	0.0012	0.0299	0.0024	2.22	1.01	<190	N/A
02/06/07	0.0031	0.0010	0.0308	0.0022				
02/13/07	0.0060	0.0011	0.0348	0.0023				
02/20/07	0.0029	0.0008	0.0252	0.0020				
02/27/07	0.0035	0.0010	0.0218	0.0019	<2.28	N/A	<198	N/A
03/06/07	0.0027	0.0008	0.0267	0.0020				
03/13/07	0.0022	0.0008	0.0203	0.0019				
03/20/07	0.0037	0.0011	0.0249	0.0021				
03/27/07	0.0030	0.0009	0.0247	0.0019	2.35	1.07	<196	N/A
04/03/07	0.0031	0.0010	0.0226	0.0020				
04/10/07	0.0041	0.0011	0.0291	0.0022				
04/17/07	0.0043	0.0011	0.0264	0.0021				
04/24/07	0.0020	0.0009	0.0196	0.0019	<2.24	N/A	<195	N/A
05/01/07	0.0034	0.0010	0.0255	0.0021				
05/08/07	0.0039	0.0010	0.0209	0.0018				
05/14/07	0.0022	0.0009	0.0147	0.0019				
05/22/07	0.0032	0.0008	0.0253	0.0019				
05/29/07	0.0032	0.0009	0.0306	0.0022	<2.22	N/A	<193	N/A
06/05/07	0.0044	0.0010	0.0324	0.0023				
06/11/07	0.0029	0.0009	0.0217	0.0020				
06/19/07	0.0035	0.0010	0.0214	0.0018				
06/26/07	0.0025	0.0009	0.0263	0.0020	<2.32	N/A	<202	N/A
07/03/07	0.0024	0.0008	0.0150	0.0017				
07/11/07	0.0029	0.0008	0.0220	0.0019				
07/18/07	0.0033	0.0010	0.0215	0.0019				
07/24/07	0.0020	0.0007	0.0167	0.0016	<2.19	N/A	208	89
07/31/07	0.0026	0.0009	0.0205	0.0019				
08/07/07	0.0026	0.0009	0.0255	0.0021				
08/14/07	0.0042	0.0011	0.0445	0.0027				
08/21/07	0.0042	0.0011	0.0319	0.0023				
08/28/07	0.0017	0.0008	0.0155	0.0017	<2.25	N/A	<196	N/A
09/04/07	0.0039	0.0009	0.0363	0.0022				
09/11/07	0.0017	0.0007	0.0284	0.0021				
09/18/07	0.0027	0.0010	0.0147	0.0019				
09/25/07	0.0022	0.0009	0.0149	0.0019	<2.25	N/A	<196	N/A
10/02/07	0.0086	0.0015	0.0313	0.0024				
10/09/07	0.0030	0.0010	0.0130	0.0017				
10/16/07	0.0072	0.0014	0.0335	0.0026				
10/23/07	0.0037	0.0010	0.0324	0.0022				
10/30/07	0.0016	0.0020	0.0026	0.0023	<2.33	N/A	<203	N/A
11/06/07	0.0101	0.0017	0.0197	0.0021				
11/13/07	0.0093	0.0016	0.0190	0.0021				
11/20/07	0.0017	0.0009	0.0066	0.0014				
11/27/07	0.0032	0.0011	0.0287	0.0024	<2.19	N/A	<190	N/A
12/04/07	0.0114	0.0018	0.0188	0.0020				
12/11/07	0.0133	0.0019	0.0844	0.0038				
12/20/07	0.0031	0.0009	0.0159	0.0016				
12/27/07	0.0076	0.0014	0.0507	0.0030	<2.25	N/A	<196	N/A

Routine Radiological Atmospheric Monitoring Data, 2007

Sample Location:	**Snelling, SC (SCT)**							
Date	**Gross Alpha in Air**		**Gross Beta in Air**		**Tritium in Air**		**Tritium in Rain**	
	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/L	+- 2 sigma
01/02/07	0.0034	0.0009	0.0242	0.0021				
01/09/07	0.0028	0.0008	0.0181	0.0017				
01/16/07	0.0022	0.0008	0.0134	0.0016				
01/24/07	0.0026	0.0008	0.0204	0.0017				
01/30/07	0.0027	0.0010	0.0291	0.0022	6.54	1.18	423	98
02/06/07	0.0025	0.0009	0.0299	0.0021				
02/13/07	0.0010	0.0005	0.0038	0.0010				
02/20/07	0.0024	0.0007	0.0235	0.0019				
02/27/07	0.0026	0.0008	0.0216	0.0019	4.97	1.15	432	102
03/06/07	0.0021	0.0008	0.0230	0.0019				
03/13/07	0.0029	0.0009	0.0249	0.0020				
03/20/07	0.0040	0.0011	0.0219	0.0019				
03/27/07	0.0036	0.0011	0.0316	0.0023	8.08	1.28	431	100
04/03/07	0.0033	0.0010	0.0218	0.0019				
04/10/07	0.0028	0.0009	0.0276	0.0021				
04/17/07	0.0039	0.0010	0.0224	0.0018				
04/24/07	0.0020	0.0008	0.0164	0.0016	7.30	1.24	420	100
05/01/07	0.0029	0.0009	0.0193	0.0018				
05/08/07	0.0033	0.0010	0.0247	0.0020				
05/14/07	0.0017	0.0008	0.0163	0.0019				
05/22/07	0.0034	0.0008	0.0244	0.0019				
05/29/07	0.0044	0.0010	0.0298	0.0022	7.11	1.22	471	101
06/05/07	0.0042	0.0010	0.0318	0.0022				
06/11/07	0.0033	0.0010	0.0233	0.0021				
06/19/07	0.0030	0.0009	0.0232	0.0019				
06/26/07	0.0018	0.0008	0.0257	0.0020	7.13	1.27	215	94
07/03/07	0.0021	0.0008	0.0213	0.0020				
07/11/07	0.0028	0.0008	0.0235	0.0019				
07/18/07	0.0035	0.0009	0.0196	0.0018				
07/24/07	0.0017	0.0007	0.0168	0.0016	7.88	1.24	295	93
07/31/07	0.0024	0.0008	0.0189	0.0018				
08/07/07	0.0032	0.0009	0.0328	0.0023				
08/14/07	0.0031	0.0009	0.0364	0.0024				
08/21/07	0.0038	0.0010	0.0314	0.0022				
08/28/07	0.0018	0.0008	0.0147	0.0016	4.13	1.12	311	95
09/04/07	0.0039	0.0009	0.0323	0.0021				
09/11/07	0.0022	0.0008	0.0237	0.0019				
09/18/07	0.0036	0.0011	0.0146	0.0018				
09/25/07	0.0033	0.0011	0.0218	0.0022	5.72	1.18	293	94
10/02/07	0.0038	0.0011	0.0145	0.0018				
10/09/07	0.0032	0.0010	0.0154	0.0018				
10/16/07	0.0069	0.0014	0.0332	0.0025				
10/23/07	0.0034	0.0009	0.0301	0.0020				
10/30/07	0.0033	0.0010	0.0177	0.0020	7.14	1.27	<203	N/A
11/06/07	0.0053	0.0013	0.0486	0.0030				
11/13/07	0.0085	0.0015	0.0610	0.0033				
11/20/07	0.0049	0.0013	0.0335	0.0025				
11/27/07	0.0036	0.0011	0.0293	0.0024	5.55	1.15	195	89
12/04/07	0.0028	0.0011	0.0052	0.0013				
12/11/07	0.0127	0.0019	0.0078	0.0037				
12/20/07	0.0015	0.0007	0.0136	0.0014				
12/27/07	0.0075	0.0014	0.0495	0.0030	4.44	1.09	199	94

Routine Radiological Atmospheric Monitoring Data, 2007

Sample Location:	Williston, SC (WIL)							
Date	**Gross Alpha in Air**		**Gross Beta in Air**		**Tritium in Air**		**Tritium in Rain**	
	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/L	+- 2 sigma
01/02/07	0.0029	0.0009	0.0215	0.0020				
01/09/07	0.0021	0.0007	0.0189	0.0017				
01/16/07	NS	N/A	NS	N/A				
01/24/07	0.0023	0.0007	0.0155	0.0015				
01/30/07	0.0028	0.0011	0.0284	0.0023	6.78	1.20	468	97
02/06/07	0.0031	0.0010	0.0243	0.0020				
02/13/07	0.0047	0.0010	0.0304	0.0022				
02/20/07	0.0028	0.0008	0.0216	0.0019				
02/27/07	0.0026	0.0008	0.0175	0.0017	5.98	1.20	276	95
03/06/07	0.0027	0.0008	0.0227	0.0019				
03/13/07	0.0018	0.0007	0.0183	0.0018				
03/20/07	0.0037	0.0011	0.0216	0.0020				
03/27/07	0.0026	0.0008	0.0222	0.0018	3.73	1.12	368	99
04/03/07	0.0030	0.0010	0.0220	0.0020				
04/10/07	0.0030	0.0010	0.0243	0.0020				
04/17/07	0.0033	0.0009	0.0215	0.0019				
04/24/07	0.0014	0.0008	0.0156	0.0016	4.70	1.14	367	98
05/01/07	0.0035	0.0010	0.0189	0.0018				
05/08/07	0.0027	0.0009	0.0217	0.0019				
05/14/07	0.0023	0.0009	0.0136	0.0018				
05/22/07	0.0032	0.0008	0.0220	0.0018				
05/29/07	0.0030	0.0008	0.0244	0.0020	2.81	1.06	319	96
06/05/07	0.0043	0.0010	0.0287	0.0021				
06/11/07	0.0031	0.0009	0.0244	0.0022				
06/19/07	0.0019	0.0008	0.0184	0.0017				
06/26/07	0.0025	0.0009	0.0238	0.0019	4.10	1.15	410	103
07/03/07	0.0027	0.0009	0.0154	0.0017				
07/11/07	0.0028	0.0008	0.0214	0.0018				
07/18/07	0.0020	0.0008	0.0174	0.0017				
07/24/07	0.0016	0.0007	0.0121	0.0014	4.14	1.10	291	93
07/31/07	0.0023	0.0008	0.0162	0.0017				
08/07/07	0.0029	0.0009	0.0276	0.0021				
08/14/07	0.0030	0.0009	0.0282	0.0021				
08/21/07	0.0037	0.0009	0.0258	0.0019				
08/28/07	<0.0009	N/A	0.0010	0.0008	4.37	1.14	311	96
09/04/07	0.0034	0.0009	0.0297	0.0020				
09/11/07	0.0028	0.0009	0.0232	0.0020				
09/18/07	0.0098	0.0016	0.0225	0.0022				
09/25/07	0.0050	0.0013	0.0329	0.0026	3.70	1.10	219	92
10/02/07	0.0060	0.0013	0.0241	0.0022				
10/09/07	0.0029	0.0010	0.0132	0.0018				
10/16/07	0.0039	0.0011	0.0244	0.0022				
10/23/07	0.0038	0.0010	0.0292	0.0021				
10/30/07	0.0021	0.0009	0.0123	0.0017	<2.34	N/A	240	96
11/06/07	0.0045	0.0012	0.0349	0.0026				
11/13/07	0.0056	0.0013	0.0412	0.0027				
11/20/07	0.0039	0.0012	0.0279	0.0024				
11/27/07	0.0033	0.0011	0.0197	0.0021	4.21	1.10	266	92
12/04/07	0.0111	0.0018	0.0181	0.0020				
12/11/07	0.0096	0.0016	0.0543	0.0030				
12/20/07	0.0019	0.0007	0.0133	0.0014				
12/27/07	0.0061	0.0013	0.0402	0.0027	5.00	1.14	209	93

Routine Radiological Atmospheric Monitoring Data, 2007

Sample Location:	Beaufort Air Sation (BEU)							
Date	Gross Alpha in Air		Gross Beta in Air		Tritium in Air		Tritium in Rain	
	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/L	+- 2 sigma
01/05/07	0.0018	0.0003	0.0099	0.0006				
01/25/07	0.0011	0.0003	0.0121	0.0008	<2.30	N/A	<200	N/A
02/09/07	0.0054	0.0006	0.0391	0.0014				
02/22/07	0.0030	0.0005	0.0105	0.0081	<2.30	N/A	<200	N/A
03/06/07	0.0029	0.0005	0.0340	0.0013				
04/16/07	0.0027	0.0005	0.0336	0.0013	<2.30	N/A	<200	N/A
05/01/07	0.0015	0.0004	0.0104	0.0008				
05/17/07	0.0076	0.0008	0.0971	0.0008	<2.31	N/A	<201	N/A
06/04/07	0.0024	0.0005	0.0099	0.0008				
06/22/07	0.0062	0.0007	0.0296	0.0012	<2.25	N/A	<196	N/A
07/06/07	0.0028	0.0005	0.0062	0.0007				
07/17/07	0.0048	0.0008	0.0373	0.0017	<2.12	N/A	<184	N/A
08/06/07	0.0026	0.0051	0.0076	0.0008				
08/24/07	0.0067	0.0007	0.0308	0.0013	<1.36	N/A	<188	N/A
09/11/07	0.0025	0.0004	0.0188	0.0010				
09/24/07	0.0059	0.0007	0.0319	0.0014	<2.29	N/A	<199	N/A
10/09/07	0.0050	0.0006	0.0281	0.0012				
10/29/07	0.0016	0.0003	0.0102	0.0007	<2.09	N/A	<182	N/A
11/14/07	0.0075	0.0008	0.0291	0.0014				
11/29/07	0.0096	0.0010	0.0048	0.0011	<2.25	N/A	<196	N/A
12/14/07	0.0041	0.0006	0.0239	0.0013				

Back to List of Data Tables

1.1.5 Summary Statistics

Radiological Atmospheric Monitoring

Statistical Review of Ambient TLD Beta/Gamma Data Summary 2007 19

Summary Statistics..... 20

Back to List of Statistical Summaries

Note:
1. Avg—Average
2. Std Dev—Standard Deviation
3. Min—Minimum
4. Max—Maximum
5. N—Number of Samples
6. LLD—Lower Limit of Detection
7. ( )—Number of Samples Below LLD

Statistical Review of Ambient TLD Beta/Gamma Data Summary 2007

Sample Location	Quarterly Avg	Std Dev	Min	Max	Median
	mrem	mrem	mrem	mrem	mrem
Colocated with Aiken Air Station	23.50	2.08	21.00	26.00	23.50
E Area	37.50	1.00	37.00	39.00	37.00
Green Pond	28.75	2.63	25.00	31.00	29.50
Colocated with Jackson Air Station	25.75	0.96	25.00	27.00	25.50
Crackerneck Gate	29.75	3.20	27.00	33.00	29.50
TNX Boat Ramp	30.25	3.77	25.00	34.00	31.00
Colocated with Allendale Barricade	27.00	2.83	23.00	29.00	28.00
Junction of Millet Road and Round Tree Road	30.25	2.63	28.00	34.00	29.50
Patterson Mill Road At Lower Three Runs	30.50	3.70	26.00	35.00	30.50
Colocated with Allendale Air station	25.75	0.96	25.00	27.00	25.50
Barnwell Airport	28.25	2.22	26.00	31.00	28.00
Colocated with Snelling Air Station	28.75	3.77	25.00	34.00	28.00
Colocated with Williston Air Station	26.50	2.52	24.00	30.00	26.00
Bates Cemetery	28.00	2.58	25.00	31.00	28.00
Williston Police Department	29.75	2.06	27.00	32.00	30.00
Junction of US 278 and SC 781	29.75	2.63	27.00	32.00	30.00
US 278 near Upper Three Runs	29.75	2.75	27.00	33.00	29.50
Colocated with New Ellenton Air Station	28.00	1.83	26.00	30.00	28.00
Windsor Post Office	28.25	1.26	27.00	30.00	28.00
Beaufort	28.75	0.96	28.00	30.00	28.5

Summary Statistics

Statistical Review Of Radiological Monitoring at Aiken Elementary Water Tower (AIK)				
Analyte	Gross Alpha	Gross Beta	Tritium in Air	Tritium in Rain
Units	pCi/m3	pCi/m3	pCi/m3	pCi/L
N	52 (0)	52 (0)	12 (9)	12 (11)
Average	0.004	0.024	4.28	One detect of 224 pCi/L
Std Dev	0.003	0.010	0.49	
Median	0.003	0.022	4.13	
Min	0.001	0.012	3.89	
Max	0.019	0.066	4.83	

Statistical Review Of Radiological Monitoring at New Ellenton, SC (NEL)				
Analyte	Gross Alpha	Gross Beta	Tritium in Air	Tritium in Rain
Units	pCi/m3	pCi/m3	pCi/m3	pCi/L
N	51 (1)	51 (0)	12 (0)	12 (8)
Average	0.005	0.026	5.57	274
Std Dev	0.010	0.011	0.70	87
Median	0.003	0.023	5.78	246
Min	0.002	0.005	4.43	207
Max	0.069	0.064	6.53	398

Statistical Review Of Radiological Monitoring at Jackson, SC (JAK)				
Analyte	Gross Alpha	Gross Beta	Tritium in Air	Tritium in Rain
Units	pCi/m3	pCi/m3	pCi/m3	pCi/L
N	52 (0)	52 (0)	12 (0)	12 (5)
Average	0.003	0.026	5.42	267
Std Dev	0.002	0.012	1.22	69
Median	0.003	0.025	5.51	254
Min	0.001	0.002	3.58	195
Max	0.010	0.071	7.03	399

Summary Statistics

Statistical Review of Radiological Monitoring at Burial Grounds North, SRS (BGN)				
Analyte	Gross Alpha	Gross Beta	Tritium in Air	Tritium in Rain
Units	pCi/m3	pCi/m3	pCi/m3	pCi/L
N	52 (0)	52 (0)	12 (0)	12 (0)
Average	0.004	0.025	224	3813
Std Dev	0.003	0.011	22	555
Median	0.003	0.024	230	3947
Min	0.002	0.012	185	2565
Max	0.019	0.072	250	4289

Statistical Review Of Radiological Monitoring at Allendale Barricade (ABR)				
Analyte	Gross Alpha	Gross Beta	Tritium in Air	Tritium in Rain
Units	pCi/m3	pCi/m3	pCi/m3	pCi/L
N	52 (5)	52 (0)	12 (3)	12 (1)
Average	0.003	0.020	3.44	302
Std Dev	0.003	0.016	1.17	79
Median	0.002	0.017	2.92	311
Min	0.001	0.002	2.24	204
Max	0.012	0.090	5.81	431

Statistical Review Of Radiological Monitoring at Allendale, SC (ALN)				
Analyte	Gross Alpha	Gross Beta	Tritium in Air	Tritium in Rain
Units	pCi/m3	pCi/m3	pCi/m3	pCi/L
N	52 (0)	52 (0)	12 (10)	12 (11)
Average	0.004	0.025	2.29	One detect 208 pCi/L
Std Dev	0.003	0.012	0.09	
Median	0.003	0.023	2.29	
Min	0.002	0.003	2.22	
Max	0.013	0.084	2.35	

Summary Statistics

Statistical Review Of Radiological Monitoring at Snelling, SC (SCT)				
Analyte	Gross Alpha	Gross Beta	Tritium in Air	Tritium in Rain
Units	pCi/m3	pCi/m3	pCi/m3	pCi/L
N	52 (0)	52 (0)	12 (0)	12 (1)
Average	0.003	0.024	6.33	335
Std Dev	0.002	0.010	1.33	104
Median	0.003	0.023	6.83	311
Min	0.001	0.004	4.13	195
Max	0.013	0.061	8.08	471

Statistical Review Of Radiological Monitoring at Williston, SC (WIL)				
Analyte	Gross Alpha	Gross Beta	Tritium in Air	Tritium in Rain
Units	pCi/m3	pCi/m3	pCi/m3	pCi/L
N	51 (1)	51 (0)	12 (1)	12 (0)
Average	0.004	0.023	4.50	312
Std Dev	0.002	0.008	1.10	79
Median	0.003	0.022	4.21	301
Min	0.001	0.001	2.81	209
Max	0.0111	0.054	6.78	468

Statistical Review Of Radiological Monitoring at Beaufort, SC (BEU)				
Analyte	Gross Alpha	Gross Beta	Tritium in Air	Tritium in Rain
Units	pCi/m3	pCi/m3	pCi/m3	pCi/L
N	21 (0)	21 (0)	10 (10)	10 (10)
Average	0.004	0.025	<LLD	<LLD
Std Dev	0.002	0.020		
Median	0.003	0.024		
Min	0.001	0.005		
Max	0.010	0.097		

Back to List of Statistical Summaries

2.1 Ambient Groundwater Monitoring Adjacent to SRS

2.1.1 Summary

The Environmental Surveillance and Oversight Program (ESOP) of the South Carolina Department of Health and Environmental Control (SCDHEC) samples an ambient groundwater monitoring network adjacent to the Savannah River Site (SRS) and is building a database to characterize groundwater quality in the area. This well network consists of existing groundwater wells owned by neighboring municipalities, businesses, and members of the public. Radiological and non-radiological contaminants have historically been detected in some groundwater wells. ESOP provides this project report annually as an independent source of information concerning Department of Energy-Savannah River (DOE-SR) activities and the potential impacts of those activities to public health and the environment.

DOE-SR currently utilizes a regional monitoring network consisting of approximately 230 groundwater monitoring wells. These wells, which are not routinely sampled, are maintained and sampled by various agencies. These agencies include DOE-SR, SCDHEC, South Carolina Department of Natural Resources (SCDNR), and the United States Geological Survey (USGS). ESOP has identified and considered wells in this network for inclusion in the ESOP Ambient Groundwater Monitoring Network (AGMN). For a more detailed review of background information, please refer to "A Determination of Ambient Groundwater Quality Adjacent to Savannah River Site, Annual Report 1997" (SCDHEC 1999a).

The ESOP Ambient Groundwater Quality Monitoring Project (AGQMP) evaluates ambient groundwater quality adjacent to SRS. This annual evaluation is conducted to determine possible offsite groundwater impacts due to operations conducted at SRS. The following items outline the objectives of the project, as well as the importance of sampling, for radionuclides throughout the groundwater well network:

- Evaluate groundwater quality adjacent to SRS;
- Compare results with historical data;
- Determine any SRS contaminant migration offsite;
- Expand current ambient water quality databases; and
- Provide the public with independently generated, region specific, groundwater quality information.

The study area (Section 2.1.2, Map 3) is composed of a 10-mile perimeter extending from the SRS boundary, as well as background locations found throughout the state of South Carolina. ESOP evaluates five aquifer zones, from the water table to confined aquifers more than 1400 feet deep. Map 3 depicts the network well locations and the approximate extent of the study area. The wells sampled in 2007 are depicted.

The SCDHEC analytical laboratory data from the 2007 groundwater sampling event revealed very few contaminants present in the groundwater wells sampled and the immediate surrounding area. These groundwater wells and nature and extent of the contaminants will be detailed in the results and discussion section of this report. Due to the low concentrations and limited extent of

the contaminants identified in these groundwater wells, it is likely the sources of these contaminants are a result of naturally occurring processes in the subsurface.

RESULTS AND DISCUSSION

The 2007 groundwater sampling event was comprised of (22) twenty-two wells. Seven of these wells (Section 2.1.2, Map 3) are classified as network wells and the remaining (15) fifteen are designated as background and perimeter wells. Based on a review of the wet chemistry, metals, tritium, alpha-, beta-, and gamma-emitting radioisotope analytical data provided by the SCDHEC analytical and radiological laboratories, various contaminants were detected in the (22) twenty-two groundwater wells sampled.

Radium 226 (Ra-226), alpha, and beta activity were detected at (13) thirteen monitoring well locations, none of which exceeded the Maximum Contaminant Limit (MCL) for these radioisotopes. Lead 214 (Pb-214) was detected at a concentration of 8.90 pCi/L at groundwater well D03010. The concentration of Pb-214 detected is well below the USEPA established maximum exposure drinking water standard of 4.0 mrem/year.

The 2007 groundwater sampling event revealed an additional contaminant in another groundwater well location. This well is identified as G03121 (Clariant well). The sample collected from this well revealed an iron concentration of 0.61 milligrams per liter (mg/L). The secondary drinking water standard (established by the USEPA) indicates an MCL for iron of 0.30 mg/L. Although the concentration of iron in this sample indicates an exceedance of the secondary drinking water standard, the USEPA has not established a primary drinking water standard for iron in water. Historical data (collected during the 2002 sample event), indicates an iron concentration of 0.79 mg/L at groundwater well G03121. This information suggests a declining trend in iron concentration at this location. The concentration of iron present in groundwater monitoring well G03121, although slightly elevated, does not pose a known health risk to humans.

During the 2007 groundwater sampling event, it appears (3) of the wells listed in (Section 2.1.3, Table 1), were not sampled (I03002, G03112 and G03115). However, the groundwater sampling schedule will be reconfigured to incorporate these wells into future sample events as time permits.

Metals

The presence of metals in the environment can be attributed to man-made processes such as industrial manufacturing and/or the natural decay of deposits. A review of the following metal contaminants detected indicates their presence is most likely due to the erosion of natural deposits. In addition, the position of these wells relative to the hydraulically cross-gradient location of SRS's centrally located process areas supports the theory of natural occurrence.

Barium was detected in groundwater well G03121 at a concentration of 0.11 mg/L. The MCL for barium is 2.0 mg/L. No average was calculated for barium. There were no other wells sampled in 2007, which revealed detectable concentrations of barium.

Copper was detected at a concentration of 0.011 mg/L in duplicate sample (DUP-01). This sample was collected in conjunction with groundwater well G06151. Laboratory data indicates concentrations for copper at G06151 were below detection limits. The result for this sample was <0.010 mg/L. The MCL for copper is 1.3 mg/L. No average was calculated for copper. There were no other wells sampled in 2007 that revealed detectable concentrations of copper.

Anions

Fluoride was detected at concentrations well below the 4 mg/L MCL in (3) three monitoring wells. The presence of fluoride is most likely due to the erosion of natural deposits. Calculation of summary statistics revealed a fluoride average of 0.14 (± 0.02) mg/L.

Nitrate/Nitrite was detected at concentrations well below the 10 mg/L MCL in (9) nine groundwater monitoring wells. The presence of nitrate/nitrite is most likely due to the erosion of natural deposits and/or runoff from fertilizer use. Once in the soil, nitrate is mobile due to it's water solubility characteristic; and, therefore, moves easily through the soil matrix at a speed comparable to groundwater flow velocity. Calculation revealed a nitrate/nitrite average of 0.27 (± 0.47) mg/L over these (9) nine groundwater well locations.

Radionuclides

Samples for alpha-emitting, beta-emitting, gamma-emitting, and tritium radioisotopes were collected. Gross alpha was detected in (4) four of the (22) twenty-two groundwater wells analyzed (Section 2.1.3, Figure 1). None of the (4) four gross alpha detections exceeded the MCL.

As the presence of naturally occurring radionuclides have been well documented in the groundwater regime across the state of South Carolina, the concentrations of gross alpha in the (4) four wells (not exceeding the MCL) are likely due to the natural decay process of uranium deposits within the subsurface. Calculation of summary statistics revealed a gross alpha average of 8.40 (± 0.91) picocuries per liter (pCi/L) for the background population and an average of 5.56 (± 3.38) pCi/L for the groundwater network wells sampled during the 2007 event. These calculations reveal a gross alpha average for the network wells that is less than the average background concentration.

Gross non-volatile beta was detected in (1) one of the (22) twenty-two monitoring wells that were analyzed. The "Town of Walterboro" sample with a concentration of 3.37 pCi/L, did not exceed the MCL for gross non-volatile beta. As the presence of naturally occurring radionuclides has been well documented in the groundwater regime across the state of South Carolina, the concentration of gross non-volatile beta in this well is likely due to the natural decay process of uranium deposits within the subsurface. There was no average calculated for gross non-volatile beta due to a single detection.

Pb-214 was detected at a concentration of 8.90 pCi/L at groundwater well D03010. The Town of Martin Post Office utilizes groundwater well D03010. Currently, the USEPA has not established an MCL for Pb-214.

Tritium was not detected in any of the samples collected during the 2007 groundwater sampling event. However, as stakeholder interests in tritium levels continue to rise (DOE 2006), tritium will be sampled for and addressed in future project reports.

ESOP and DOE-SR Data Comparison

Because DOE-SR collects groundwater samples from a separate monitoring well network, direct comparisons could not be made to their findings in the latest SRS Environmental Report for 2007. However, the 2007 SRS report identifies numerous areas of groundwater contamination throughout the SRS property. These areas of impacted groundwater include: A Area, C Area, D Area, E Area, F Area, H Area, K Area, L Area, M Area, P Area, Sanitary Landfill, TNX and CMP Pits. The extent of the contamination varies and the contaminants include: Trichloroethylene (TCE), Perchloroethylene (PCE), Tritium, Gross Alpha, Beta, and Vinyl Chloride. Due to the presence of TCE, PCE and Vinyl Chloride in the groundwater on SRS, the ESOP groundwater project will begin sampling for these contaminants beginning in 2009.

CONCLUSIONS AND RECOMMENDATIONS

Statistical results acquired from ESOP perimeter and background sampling locations tend to support DOE-SR findings (WSRC 2008a) that radiological and nonradiological contaminants associated with SRS activities have not migrated off the SRS via groundwater. These findings suggest there is minimal contamination present throughout the subsurface in and around the groundwater wells sampled during the 2007 ESOP sampling event. Analytical results are summarized in Section 2.1.4.

A review of the 2007 analytical data revealed various but limited nonradiological and/or radiological constituents in all (22) twenty-two groundwater wells sampled. Pb-214 was detected at a concentration of 8.90 pCi/L at groundwater well D03010, utilized by the Town of Martin Post Office. Although these concentrations are elevated, the data suggests the extent of the contaminants are isolated and likely the result of dissolved metals and radionuclides from naturally occurring geologic formations.

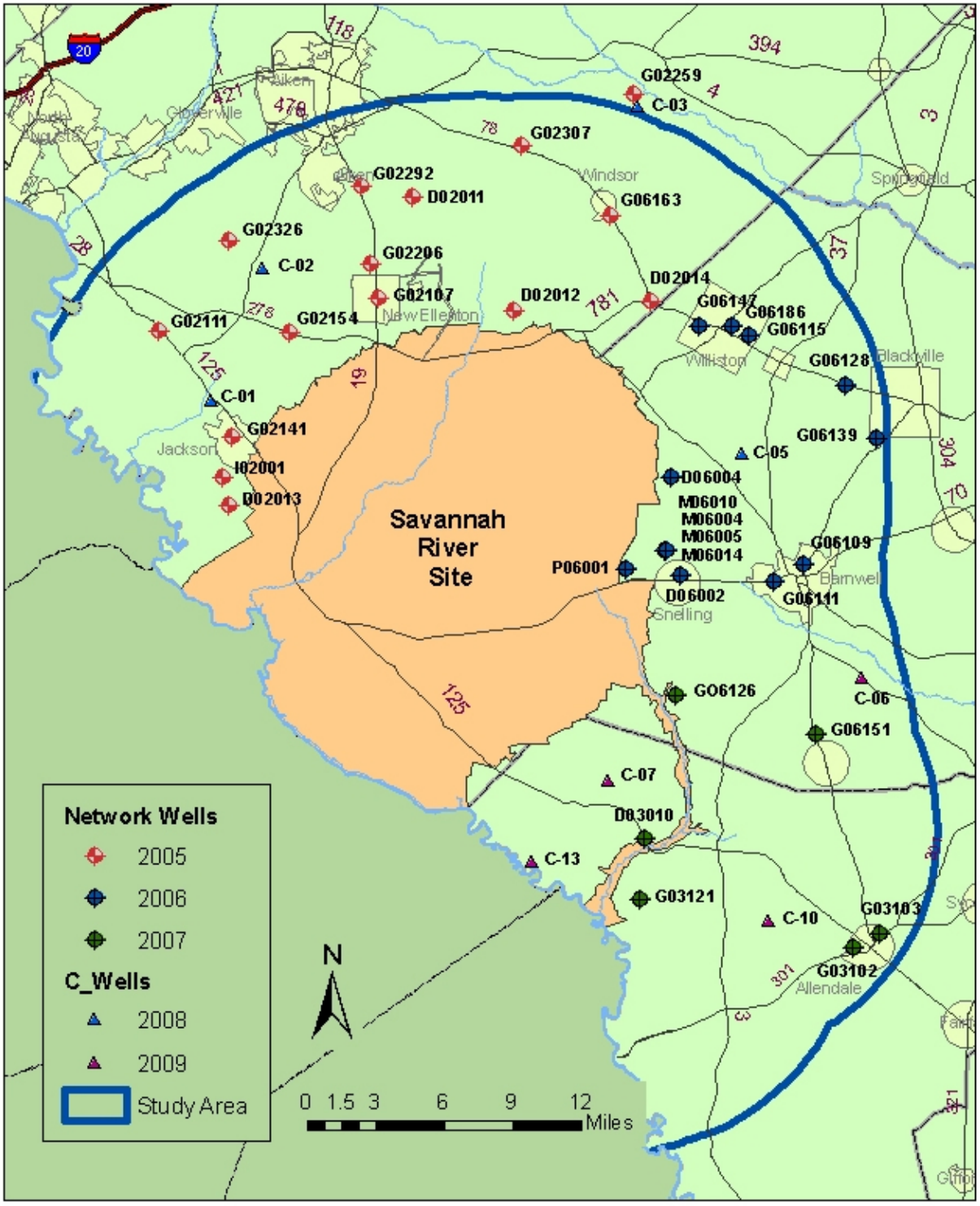
The AGQMP attempted to determine if constituents, other than naturally occurring, have impacted groundwater within the AGMN. The results of the 2007 groundwater sampling event indicate several non-radiological constituents and naturally occurring radioisotopes are impacting groundwater quality in isolated regions throughout the groundwater monitoring well network. Independent monitoring of basic water quality parameters, metals, tritium, gross alpha, non-volatile beta, and gamma-emitting radioisotopes will continue throughout future annual groundwater investigations. In addition, statistical analysis of perimeter and background data along with evaluating DOE-SR groundwater monitoring data will be performed. Continued groundwater monitoring will provide a better understanding of actual groundwater quality parameters, their extent, and trends. As a result, the ability to compare most recent data with historical data can be achieved. In addition, ESOP will provide SCDHEC's Bureau of Water with groundwater data to assist in their evaluation of the extent of naturally occurring radioisotopes in the region.

During future DOE-SR groundwater sampling events, SCDHEC will request the opportunity to conduct split (Quality Assurance/Quality Control) sampling. Split sampling at random well locations throughout the SRS groundwater well network will help provide SCDHEC further confirmation of the analytical results provided by DOE-SR annually.

Back to Table of Contents

2.1.2
Map 3. Ambient Groundwater Network

Back to Maps



2.1.3 Tables and Figures
Ambient Groundwater Monitoring

Table 1 ESOP Groundwater Monitoring Well Data

Well No.	Well Name	Sample Year	Top of Casing Elevation (ft amsl)	Total Depth (ft bgs)	Aquifer
G02292	Hunter's Glen	2005	unknown	210	SP
G02206	Oak Hill Subdivision	2005	445	240	SP
G02107	New Ellenton	2005	421	425	CB
G06163	Mitchum MHP	2005	365	117	SP
G02259	Aiken State Park	2005	262	*	SP
G02154	Talatha Water District	2005	250	185	CB
G02141	Jackson	2005	225	105	SP
G02111	Beech Island Water District	2005	380	360	CB
G02326	ORA Site	2005	300	397	MB
D02014	Messer Well	2005	unknown	144	SP
G02307	Oakwood School	2005	428	404	CB
D02013	Cowden Plantation, Well 2	2005	124	*	SP
I02001	Cowden Plantation, Well 1	2005	132	*	CB
D02011	Mettlen Well	2005	400	180	SP
D02012	Windsome Plantation, House Well	2005	260	*	SP
G06109	Barnwell, Hwy. 3	2006	230	146	UTR
G06111	Barnwell, Rose St.	2006	220	166	UTR
G06128	Edisto Station	2006	322	360	GOR
G06147	Williston, Halford St.	2006	352	530	CB
G06113	Williston, Dewey Ct.	2006	353	125	UTR
G06115	Williston, Industrial Park	2006	360	685	MB
G06139	Barnwell State Park	2006	248	163	UTR
D06002	Moore Well	2006	240	*	UTR
P06001	Allied General Nuclear, Well 1	2006	250	*	MB
D06004	J. Williams Well	2006	245	76.15	UTR
M06004	Chem Nuclear WO0061	2006	254.52	401	CB
M06014	Chem Nuclear WO0071	2006	255.33	250	GOR
M06005	Chem Nuclear WO0067	**2006**	254.76	46.79	UTR
M06010	Chem Nuclear WO0069	2006	254.28	145	UTR
D03010	Martin Post Office	**2007**	108	105	UTR
I03002	Williams Grocery	2007	138	*	UTR
G03102	Allendale, Water St.	**2007**	201	343	UTR
G03103	Allendale, Googe St.	**2007**	180	347	UTR
G03112	Allendale Welcome Center	2007	143	100	UTR
G06151	Chappels Labor Camp	**2007**	250	260	UTR
G03121	Clariant	**2007**	180	812	CB
G03115	Whitlock Combing	2007	166	800	CB
G06126	Starmet (Carolina Metals)	**2007**	200	323	GOR

Notes:
1. * - Total depth unknown, Aquifer assigned based on owner information.
2. ft amsl – feet above mean sea level
3. ft bgs – feet below ground surface
4. UTR – Upper Three Runs, CB – Crouch Branch, SP – Steeds Pond, GOR – Gordon, MB- McQueen Branch

Tables and Figures
Ambient Groundwater Monitoring

Table 1 (continued) ESOP Groundwater Monitoring Well Data

Well No.	Well Name	Sample Year	Top of Casing Elevation (ft amsl)	Total Depth (ft bgs)	Aquifer
M02101	SCDNR Cluster C-01, AIK-2378	2008	220.3	185	CB
M02102	SCDNR Cluster C-01, AIK-2379	2008	224.2	266	CB
M02103	SCDNR Cluster C-01, AIK-2380	2008	228.9	385	MB
M02104	SCDNR Cluster C-01, AIK-902	2008	231.9	511	MB
M02202	SCDNR Cluster C-02, AIK-825	2008	418.8	231	CB
M02203	SCDNR Cluster C-02, AIK-824	2008	418.6	365	CB
M02204	SCDNR Cluster C-02, AIK-818	2008	418.3	425	MB
M02205	SCDNR Cluster C-02, AIK-817	2008	418.9	535	MB
M02301	SCDNR Cluster C-03, AIK-849	2008	301.6	97	SP
M02302	SCDNR Cluster C-03, AIK-848	2008	299.7	131	CB
M02303	SCDNR Cluster C-03, AIK-847	2008	299.0	193	CB
M02304	SCDNR Cluster C-03, AIK-846	2008	297.8	255	CB
M02305	SCDNR Cluster C-03, AIK-845	2008	296.9	356	MB
M02306	SCDNR Cluster C-03, AIK-826	2008	294.9	500	MB
M06501	SCDNR Cluster C-05, BRN-360	2008	264.3	140	UTR
M06502	SCDNR Cluster C-05, BRN-359	2008	265.5	214	GOR
M06503	SCDNR Cluster C-05, BRN-367	2008	263.8	285	GOR
M06504	SCDNR Cluster C-05, BRN-368	2008	265.1	443	CB
M06505	SCDNR Cluster C-05, BRN-365	2008	263.5	539	CB
M06506	SCDNR Cluster C-05, BRN-366	2008	266.7	715	MB
M06507	SCDNR Cluster C-05, BRN-358	2008	265.6	847	MB
M03706	SCDNR Cluster C-07, ALL-368	2009	246.6	691	CB
M03707	SCDNR Cluster C-07, ALL-369	2009	242.1	800	CB
M03708	SCDNR Cluster C-07, ALL-370	2009	245.1	975	MB
M03709	SCDNR Cluster C-07, ALL-358	2009	243.1	1123	MB
M03131	SCDNR Cluster C-13, Artesian	2009	80	*	GOR
M03132	SCDNR Cluster C-13, ALL-378	2009	90	1060	MB
M03701	SCDNR Cluster C-07, ALL-363	2009	246.1	105	UTR
M03702	SCDNR Cluster C-07, ALL-364	2009	245.2	225	UTR
M03703	SCDNR Cluster C-07, ALL-365	2009	244.3	333	GOR
M03704	SCDNR Cluster C-07, ALL-366	2009	243.5	400	GOR
M03705	SCDNR Cluster C-07, ALL-367	2009	245.7	566	CB
M06601	SCDNR Cluster C-06, BRN-351	2009	207.3	95	UTR
M06602	SCDNR Cluster C-06, BRN-350	2009	207.4	170	UTR
M06603	SCDNR Cluster C-06, BRN-352	2009	207.1	293	GOR

Notes:
1. * - Total depth unknown, Aquifer assigned based on owner information.
2. ft amsl – feet above mean sea level
3. ft bgs – feet below ground surface
4. UTR – Upper Three Runs, CB – Crouch Branch, SP – Steeds Pond, GOR – Gordon, MB- McQueen Branch

Tables and Figures
Ambient Groundwater Monitoring

Table 1 (continued) ESOP Groundwater Monitoring Well Data

Well No.	Well Name	Sample Year	Top of Casing Elevation (ft amsl)	Total Depth (ft bgs)	Aquifer
M06604	SCDNR Cluster C-06, BRN-354	2009	207.6	411	GOR
M06605	SCDNR Cluster C-06, BRN-353	2009	207.7	588	CB
M06608	SCDNR Cluster C-06, BRN-349	2009	208.6	1045	MB
M03101	SCDNR Cluster C-10, ALL-347	2009	281.6	1423	MB
M03102	SCDNR Cluster C-10, ALL-372	2009	282.0	155	UTR
M03103	SCDNR Cluster C-10, ALL-371	2009	282.2	217	UTR
M03104	SCDNR Cluster C-10, ALL-374	2009	280.9	580	GOR

Notes:
1. * - Total depth unknown, Aquifer assigned based on owner information.
2. ft amsl – feet above mean sea level
3. ft bgs – feet below ground surface
4. UTR – Upper Three Runs, CB – Crouch Branch, SP – Steeds Pond, GOR – Gordon, MB- McQueen Branch

Tables and Figures
Ambient Groundwater Monitoring

Summary of the Stratigraphy and Hydrostratigraphy of the Study Area

<table>
<tr><th>PERIOD/EPOCH</th><th>GROUP</th><th>FORMATION</th><th colspan="2">HYDROLOGIC UNIT</th></tr>
<tr><td>Middle Miocene</td><td>Cooper</td><td>Upland Unit</td><td colspan="2">Unsaturated Zone</td></tr>
<tr><td rowspan="6">Tertiary / Eocene</td><td rowspan="2">Barnwell</td><td>Tobacco Road</td><td rowspan="3">Steed Pond Aquifer 2 (SP)</td><td rowspan="2">Upper Three Runs Aquifer[2] (UTR)</td></tr>
<tr><td>Dry Branch/Clinchfield</td></tr>
<tr><td rowspan="4">Orangeburg</td><td>Tinker/Santee</td><td>Gordon Confining Unit</td></tr>
<tr><td>Warley Hill</td><td rowspan="2">Gordon Aquifer[2] (GOR)</td></tr>
<tr><td>Congaree</td></tr>
<tr><td rowspan="3">Black Mingo</td><td>Fourmile</td><td rowspan="3">Crouch Branch Confining Unit</td></tr>
<tr><td>Tertiary / Paleocene</td><td>Snapp</td></tr>
<tr><td>Lang Syne/Sawdust Landing</td></tr>
<tr><td rowspan="4">Late Cretaceous</td><td rowspan="4">Lumbee</td><td>Steel Creek</td><td>Crouch Branch Aquifer[2] (CB)</td></tr>
<tr><td rowspan="2">Black Creek</td><td>McQueen Branch Confining Unit</td></tr>
<tr><td rowspan="2">McQueen Branch Aquifer[2] (MB)</td></tr>
<tr><td>Middendorf</td></tr>
<tr><td>Paleozoic or Precambrian</td><td></td><td>Cape Fear
Crystalline Basement</td><td colspan="2">Appleton Confining System
Piedmont Hydrogeologic Province</td></tr>
</table>

Notes: 1. Adapted from Aadland, Gellici, Thayer, 1995.
2. Aquifers of Interest for the ESOP Ambient Groundwater Monitoring Network

Tables and Figures
Ambient Groundwater Monitoring

Summary of Contaminants Detected Above an Established MCL in 2007

Well No.	Well Name	Analyte	MCL	Concentration	Aquifer
G03121	**Clariant**	**Iron**	**0.30 mg/L***	**0.61 mg/L**	**CB**

Notes: 1. * - Indicates USEPA secondary drinking water standard.

Tables and Figures
Ambient Groundwater Monitoring

Back to Tables and Figures

Figure 1. Gross Alpha Concentrations

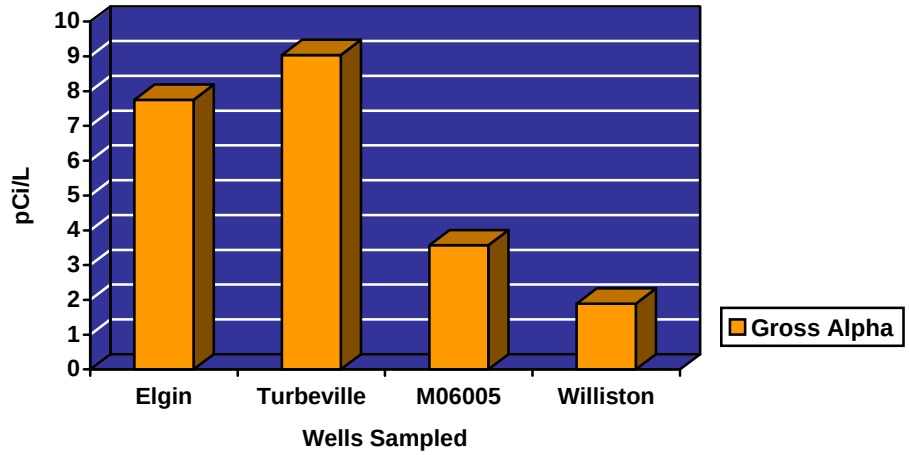
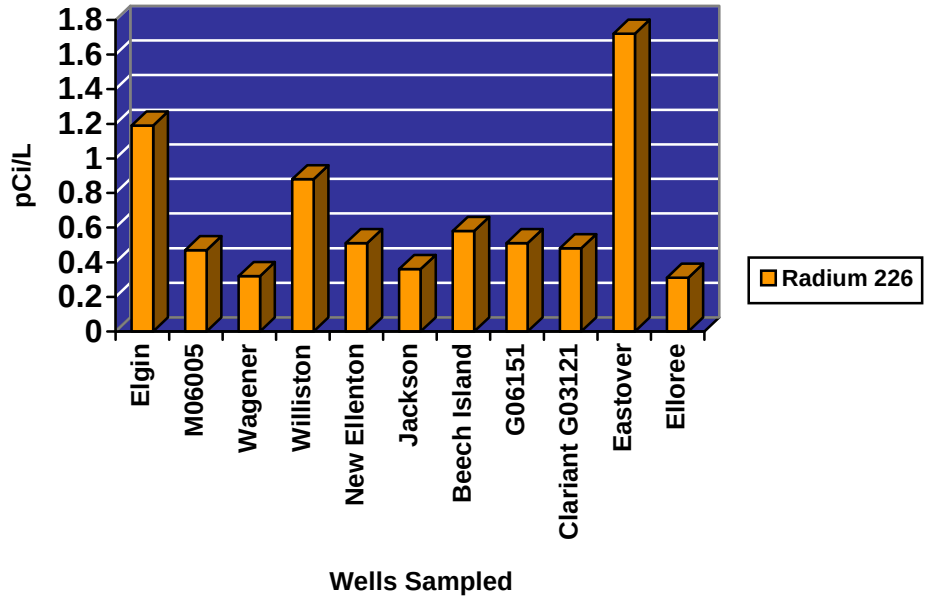


Figure 2. Radium 226 Concentrations



2.1.4 Data

Ambient Groundwater Monitoring Adjacent to SRS

Radiological and Nonradiological Analytical Data for 2007 36

Notes:
1. MDA = Minimum Detectable Activity
2. NA = Not Applicable
3. LLD = Lower Limit of Detection
4. Refer to Table 1.0 for well identification information.
5. Shaded box indicates no information available.
6. "Lab Error" indicates a malfunction with the laboratory equipment during sample analysis.

Back to List of Data Tables

Ambient Groundwater Data

AMBIENT GROUNDWATER DATA, 2007

	Well Number:		G03121		DUP-01		D03010	
	Sample Date:		10/23/2007		10/23/2007		10/24/2007	
	Sample Type:		Total	Dissolved	Total	Dissolved	Total	Dissolved
Field Measurements	Temperature	(C)		NA		NA		NA
	pH	(S.U.)		NA		NA		NA
	Conductivity	(mS/cm)		NA		NA		NA
	Dissolved Oxygen	(mg/L)		NA		NA		NA
	Turbidity	(NTU)		NA		NA		NA
	Background Radiation	(uR/hr)		NA		NA		NA
	Sample Radiation	(uR/hr)		NA		NA		NA
Chemistry	Alkalinity	(mg/L)	42.00	NA	<1.0	NA	110.00	NA
	Pth. Alkalinity	(mg/L)		NA		NA		NA
	Hardness (calculated)	(mg/L)	30.00	NA	2.40	NA	77.00	NA
	pH, Lab	(S.U.)	6.70	NA	4.80	NA	7.70	NA
	Specific Conductance (@25C)	(umhos/cm)	100.00	NA	27.00	NA	220.00	NA
	Total Dissolved Solids	(mg/L)	73.00	NA	17.00	NA	160.00	NA
	Total Organic Carbon	(mg/L)	<2.0	NA	<2.0	NA	5.80	NA
	COD in Water	(mg/L)	250.00	NA	<25	NA	46.00	NA
	Bromide	(mg/L)		NA		NA		NA
	Chloride	(mg/L)	2.00	NA	3.00	NA	2.20	NA
	Fluoride (MCL = 4)	(mg/L)	0.17	NA	<0.10	NA	0.12	NA
	Nitrite (MCL = 1)	(mg/L)		NA		NA		NA
	Nitrate/Nitrite	(mg/L)	0.03	NA	1.10	NA	0.03	NA
	Nitrate (MCL = 10)	(mg/L)		NA		NA		NA
	Ammonia	(mg/L)	0.08	NA	<0.050	NA	<0.050	NA
	Total Kjeldahl Nitrogen	(mg/L)	Lab Error	NA	Lab Error	NA	Lab Error	NA
	Phosphate, Ortho.	(mg/L)	0.06	NA	0.03	NA	<0.020	NA
	Sulfate	(mg/L)	7.00	NA	<5.0	NA	<5.0	NA
Metals	Aluminum	(mg/L)	<0.10	NA	<0.10	NA	<0.10	NA
	Antimony (MCL = 0.006)	(mg/L)	<0.050	NA	<0.050	NA	<0.050	NA
	Arsenic (MCL = 0.010)	(mg/L)	<0.0050	NA	<0.0050	NA	<0.0050	NA
	Barium (MCL = 2)	(mg/L)	0.11	NA	<0.050	NA	<0.050	NA
	Beryllium (MCL = 0.004)	(mg/L)	<0.0030	NA	<0.0030	NA	<0.0030	NA
	Boron	(mg/L)	<0.10	NA	<0.10	NA	<0.10	NA
	Cadmium (MCL = 0.005)	(mg/L)	<0.010	NA	<0.010	NA	<0.010	NA
	Calcium	(mg/L)	9.90	NA	0.58	NA	27.00	NA
	Chromium (MCL = 0.100)	(mg/L)	<0.010	NA	<0.010	NA	<0.010	NA
	Cobalt	(mg/L)	<0.020	NA	<0.020	NA	<0.020	NA
	Copper (MCL = 1.3)	(mg/L)	<0.010	NA	0.01	NA	<0.010	NA
	Iron	(mg/L)	0.61	NA	0.03	NA	0.10	NA
	Lead (MCL = 0.015)	(mg/L)	<0.050	NA	<0.050	NA	<0.050	NA
	Magnesium	(mg/L)	1.40	NA	0.24	NA	2.30	NA
	Manganese	(mg/L)	0.02	NA	<0.010	NA	0.05	NA
	Mercury (MCL = 0.0002)	(mg/L)	<0.00020	NA	<0.00020	NA	<0.00020	NA
	Molybdenum	(mg/L)	<0.020	NA	<0.020	NA	<0.020	NA
	Nickel	(mg/L)	<0.020	NA	<0.020	NA	<0.020	NA
	Potassium	(mg/L)	4.30	NA	<1.0	NA	2.00	NA
	Selenium (MCL = 0.05)	(mg/L)	<0.0050	NA	<0.0050	NA	<0.0050	NA
	Silicon	(mg/L)	5.90	NA	3.20	NA	16.00	NA
	Silver	(mg/L)	<0.030	NA	<0.030	NA	<0.030	NA
	Sodium	(mg/L)	3.60	NA	1.70	NA	6.20	NA
	Thallium (MCL = 0.002)	(mg/L)	<0.50	NA	<0.50	NA	<0.50	NA
	Tin	(mg/L)	<0.020	NA	<0.020	NA	<0.020	NA
	Titanium	(mg/L)	<0.020	NA	<0.020	NA	<0.020	NA
	Total Phosphorus	(mg/L)	0.07	NA	<0.020	NA	<0.020	NA
	Vanadium	(mg/L)	<0.020	NA	<0.020	NA	<0.020	NA
	Zinc	(mg/L)	0.02	NA	<0.010	NA	0.01	NA

Ambient Groundwater Data

AMBIENT GROUNDWATER DATA, 2007

	Well Number:		G03121		DUP-01		D03010	
	Sample Date:		10/23/2007		10/23/2007		10/24/2007	
	Sample Type:		Total	Dissolved	Total	Dissolved	Total	Dissolved
Radionuclides	Tritium (MCL = 20,000)	(pCi/L)	<189	NA	<198	NA	<189	NA
	±2	(sigma)						
	Gross Alpha (MCL = 15)	(pCi/L)	<LLD	NA	<LLD	NA	<LLD	NA
	±2	(sigma)						
	LLD	(pCi/L)	2.61		2.19		3.80	
	Gross Non-volatile Beta (MCL = 8)	(pCi/L)	<LLD	NA	<LLD	NA	<LLD	NA
	±2	(sigma)						
	LLD	(pCi/L)	2.88		2.81		3.00	
	Beryllium-7	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	pCi/L)	22.42		20.10		19.76	
	Sodium-22	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.89		1.89		1.77	
	Potassium-40	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	27.84		29.40		26.50	
	Manganese-54	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.65		1.79		1.91	
	Cobalt-58	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.93		2.06		1.98	
	Cobalt-60	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.77		1.48		1.47	
	Zinc-65	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	4.06		3.05		3.64	
	Yitrium-88	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	2.02		1.76		2.14	
	Zirconium-95	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.51		4.53		3.17	
	Ruthenium-103	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	2.69		2.62		2.67	
	Antimony-125	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	4.94		5.46		5.35	
	Iodine-131	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	17.10		21.20		17.71	
	Cesium-134	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.71		1.69		1.77	
	Cesium-137	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.91		1.83		1.89	

Ambient Groundwater Data

AMBIENT GROUNDWATER DATA, 2007

	Well Number:		G03121		DUP-01		D03010	
	Sample Date:		10/23/2007		10/23/2007		10/24/2007	
	Sample Type:		Total	Dissolved	Total	Dissolved	Total	Dissolved
Radionuclides	Cerium-144	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	15.60		16.00		16.04	
	Europium-152	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	6.21		5.62		6.02	
	Europium-154	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	4.26		4.36		4.12	
	Europium-155	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	7.34		7.40		7.51	
	Lead-212	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	4.03		3.99		4.01	
	Lead-214	(pCi/L)	<MDA	NA	<MDA	NA	8.90	NA
	±2	(sigma)					3.78	
	MDA	(pCi/L)	3.64		4.84		3.83	
	Radium-226	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	53.90		55.20		55.10	
	Actinium-228	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	8.54		8.21		7.69	
	Thorium-234	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	52.60		49.20		53.34	
	Americium-241	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	12.30		12.30		12.72	

Ambient Groundwater Data

AMBIENT GROUNDWATER DATA, 2007

	Well Number:		G06126		G03102		G03103	
	Sample Date:		10/24/2007		10/25/2007		10/25/2007	
	Sample Type:		Total	Dissolved	Total	Dissolved	Total	Dissolved
Field Measurements	Temperature	(C)		NA		NA		NA
	pH	(S.U.)		NA		NA		NA
	Conductivity	(mS/cm)		NA		NA		NA
	Dissolved Oxygen	(mg/L)		NA		NA		NA
	Turbidity	(NTU)		NA		NA		NA
	Background Radiation	(uR/hr)		NA		NA		NA
	Sample Radiation	(uR/hr)		NA		NA		NA
Chemistry	Alkalinity	(mg/L)	150.00	NA	170.00	NA	120.00	NA
	Pth. Alkalinity	(mg/L)		NA		NA		NA
	Hardness (calculated)	(mg/L)	64.00	NA	110.00	NA	100.00	NA
	pH, Lab	(S.U.)	7.80	NA	8.10	NA	8.00	NA
	Specific Conductance (@25C)	(umhos/cm)	210.00	NA	220.00	NA	210.00	NA
	Total Dissolved Solids	(mg/L)	120.00	NA	170.00	NA	160.00	NA
	Total Organic Carbon	(mg/L)	4.30	NA	<2.0	NA	<2.0	NA
	COD in Water	(mg/L)	<25	NA	<25	NA	<25	NA
	Bromide	(mg/L)		NA		NA		NA
	Chloride	(mg/L)	2.20	NA	3.30	NA	3.20	NA
	Fluoride (MCL = 4)	(mg/L)	<0.10	NA	0.12	NA	Lab Error	NA
	Nitrite (MCL = 1)	(mg/L)		NA		NA		NA
	Nitrate/Nitrite	(mg/L)	0.06	NA	0.03	NA	0.06	NA
	Nitrate (MCL = 10)	(mg/L)		NA		NA		NA
	Ammonia	(mg/L)	<0.050	NA	<0.050	NA	<0.050	NA
	Total Kjeldahl Nitrogen	(mg/L)	Lab Error	NA	Lab Error	NA	Lab Error	NA
	Phosphate, Ortho.	(mg/L)	<0.020	NA	<0.020	NA	<0.020	NA
	Sulfate	(mg/L)	<5.0	NA	<5.0	NA	<5.0	NA
Metals	Aluminum	(mg/L)	<0.10	NA	<0.10	NA	<0.10	NA
	Antimony (MCL = 0.006)	(mg/L)	<0.050	NA	<0.050	NA	<0.050	NA
	Arsenic (MCL = 0.010)	(mg/L)	<0.0050	NA	<0.0050	NA	<0.0050	NA
	Barium (MCL = 2)	(mg/L)	<0.050	NA	<0.050	NA	<0.050	NA
	Beryllium (MCL = 0.004)	(mg/L)	<0.0030	NA	<0.0030	NA	<0.0030	NA
	Boron	(mg/L)	<0.10	NA	<0.10	NA	<0.10	NA
	Cadmium (MCL = 0.005)	(mg/L)	<0.010	NA	<0.010	NA	<0.010	NA
	Calcium	(mg/L)	24.00	NA	43.00	NA	39.00	NA
	Chromium (MCL = 0.100)	(mg/L)	<0.010	NA	<0.010	NA	<0.010	NA
	Cobalt	(mg/L)	<0.020	NA	<0.020	NA	<0.020	NA
	Copper (MCL = 1.3)	(mg/L)	<0.010	NA	<0.010	NA	<0.010	NA
	Iron	(mg/L)	0.05	NA	0.08	NA	0.02	NA
	Lead (MCL = 0.015)	(mg/L)	<0.050	NA	<0.050	NA	<0.050	NA
	Magnesium	(mg/L)	1.00	NA	1.20	NA	1.00	NA
	Manganese	(mg/L)	<0.010	NA	<0.010	NA	<0.010	NA
	Mercury (MCL = 0.0002)	(mg/L)	<0.00020	NA	<0.00020	NA	<0.00020	NA
	Molybdenum	(mg/L)	<0.020	NA	<0.020	NA	<0.020	NA
	Nickel	(mg/L)	<0.020	NA	<0.020	NA	<0.020	NA
	Potassium	(mg/L)	<1.0	NA	1.60	NA	1.20	NA
	Selenium (MCL = 0.05)	(mg/L)	<0.0050	NA	<0.0050	NA	<0.0050	NA
	Silicon	(mg/L)	6.70	NA	12.00	NA	15.00	NA
	Silver	(mg/L)	<0.030	NA	<0.030	NA	<0.030	NA
	Sodium	(mg/L)	1.30	NA	2.40	NA	2.20	NA
	Thallium (MCL = 0.002)	(mg/L)	<0.50	NA	<0.50	NA	<0.50	NA
	Tin	(mg/L)	<0.020	NA	<0.020	NA	<0.020	NA
	Titanium	(mg/L)	<0.020	NA	<0.020	NA	<0.020	NA
	Total Phosphorus	(mg/L)	<0.020	NA	<0.020	NA	<0.020	NA
	Vanadium	(mg/L)	<0.020	NA	<0.020	NA	<0.020	NA
	Zinc	(mg/L)	0.07	NA	0.01	NA	<0.010	NA

Ambient Groundwater Data

AMBIENT GROUNDWATER DATA, 2007

	Well Number:		G06126		G03102		G03103	
	Sample Date:		10/24/2007		10/25/2007		10/25/2007	
	Sample Type:		Total	Dissolved	Total	Dissolved	Total	Dissolved
Radionuclides	Tritium (MCL = 20,000)	(pCi/L)	<189	NA	<189	NA	<189	NA
	±2	(sigma)						
	Gross Alpha (MCL = 15)	(pCi/L)	<LLD	NA	<LLD	NA	<LLD	NA
	±2	(sigma)						
	LLD	(pCi/L)	3.58		4.10		4.05	
	Gross Non-volatile Beta (MCL = 8)	(pCi/L)	<LLD	NA	<LLD	NA	<LLD	NA
	±2	(sigma)						
	LLD	(pCi/L)	2.99		3.02		3.02	
	Beryllium-7	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	pCi/L)	18.81		19.33		21.60	
	Sodium-22	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.55		1.65		1.75	
	Potassium-40	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	28.64		29.65		15.23	
	Manganese-54	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.84		1.69		1.66	
	Cobalt-58	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	2.17		2.03		2.00	
	Cobalt-60	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.62		1.61		1.68	
	Zinc-65	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.53		3.59		3.79	
	Yitrium-88	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	2.04		1.99		2.09	
	Zirconium-95	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.37		3.84		4.06	
	Ruthenium-103	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	2.57		3.04		2.99	
	Antimony-125	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	4.95		5.30		5.27	
	Iodine-131	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	18.45		19.35		18.80	
	Cesium-134	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.62		1.65		1.88	
	Cesium-137	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.73		1.72		1.98	

Ambient Groundwater Data

AMBIENT GROUNDWATER DATA, 2007

	Well Number:		G06126		G03102		G03103	
	Sample Date:		10/24/2007		10/25/2007		10/25/2007	
	Sample Type:		Total	Dissolved	Total	Dissolved	Total	Dissolved
Radionuclides	Cerium-144	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	15.37		16.14		15.93	
	Europium-152	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	5.03		5.57		5.89	
	Europium-154	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	4.18		3.88		4.20	
	Europium-155	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	7.69		7.33		7.67	
	Lead-212	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.96		3.86		4.32	
	Lead-214	(pCi/L)	<MDA	NA	<MDA	NA	8.95	NA
	±2	(sigma)					4.28	
	MDA	(pCi/L)	4.97		4.70		3.99	
	Radium-226	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	56.58		53.29		54.77	
	Actinium-228	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	8.03		7.40		8.15	
	Thorium-234	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	52.42		49.68		52.56	
	Americium-241	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	12.51		12.20		13.20	

Ambient Groundwater Data

AMBIENT GROUNDWATER DATA, 2007

	Well Number:		BLNK-02		BLNK-01		G06151	
	Sample Date:		10/25/2007		10/23/2007		10/23/2007	
	Sample Type:		Total	Dissolved	Total	Dissolved	Total	Dissolved
Field Measurements	Temperature	(C)		NA		NA		NA
	pH	(S.U.)		NA		NA		NA
	Conductivity	(mS/cm)		NA		NA		NA
	Dissolved Oxygen	(mg/L)		NA		NA		NA
	Turbidity	(NTU)		NA		NA		NA
	Background Radiation	(uR/hr)		NA		NA		NA
	Sample Radiation	(uR/hr)		NA		NA		NA
Chemistry	Alkalinity	(mg/L)	<1.0	NA	<1.0	NA	<1.0	NA
	Pth. Alkalinity	(mg/L)		NA		NA		NA
	Hardness (calculated)	(mg/L)	<1.0	NA	3.90	NA	2.90	NA
	pH, Lab	(S.U.)	6.10	NA	5.40	NA	4.80	NA
	Specific Conductance (@25C)	(umhos/cm)	0.76	NA	1.20	NA	27.00	NA
	Total Dissolved Solids	(mg/L)	<10	NA	<10	NA	21.00	NA
	Total Organic Carbon	(mg/L)	<2.0	NA	<2.0	NA	<2.0	NA
	COD in Water	(mg/L)	<25	NA	<25	NA	<25	NA
	Bromide	(mg/L)		NA		NA		NA
	Chloride	(mg/L)	<1.0	NA	<1.0	NA	3.10	NA
	Fluoride (MCL = 4)	(mg/L)	Lab Error	NA	<0.10	NA	<0.10	NA
	Nitrite (MCL = 1)	(mg/L)		NA		NA		NA
	Nitrate/Nitrite	(mg/L)	0.03	NA	0.03	NA	1.10	NA
	Nitrate (MCL = 10)	(mg/L)		NA		NA		NA
	Ammonia	(mg/L)	<0.050	NA	<0.050	NA	<0.050	NA
	Total Kjeldahl Nitrogen	(mg/L)	Lab Error	NA	Lab Error	NA	Lab Error	NA
	Phosphate, Ortho.	(mg/L)	<0.020	NA	0.026	NA	0.03	NA
	Sulfate	(mg/L)	<5.0	NA	<5.0	NA	<5.0	NA
Metals	Aluminum	(mg/L)	0.16	NA	<0.10	NA	<0.10	NA
	Antimony (MCL = 0.006)	(mg/L)	<0.050	NA	<0.050	NA	<0.050	NA
	Arsenic (MCL = 0.010)	(mg/L)	<0.0050	NA	<0.0050	NA	<0.0050	NA
	Barium (MCL = 2)	(mg/L)	<0.050	NA	<0.050	NA	<0.050	NA
	Beryllium (MCL = 0.004)	(mg/L)	0.01	NA	<0.0030	NA	<0.0030	NA
	Boron	(mg/L)	<0.10	NA	<0.10	NA	<0.10	NA
	Cadmium (MCL = 0.005)	(mg/L)	<0.010	NA	<0.010	NA	<0.010	NA
	Calcium	(mg/L)	0.07	NA	0.26	NA	0.60	NA
	Chromium (MCL = 0.100)	(mg/L)	<0.010	NA	<0.010	NA	<0.010	NA
	Cobalt	(mg/L)	<0.020	NA	<0.020	NA	<0.020	NA
	Copper (MCL = 1.3)	(mg/L)	<0.010	NA	<0.010	NA	<0.010	NA
	Iron	(mg/L)	0.03	NA	0.045	NA	0.05	NA
	Lead (MCL = 0.015)	(mg/L)	<0.050	NA	<0.050	NA	<0.050	NA
	Magnesium	(mg/L)	<0.050	NA	0.78	NA	0.35	NA
	Manganese	(mg/L)	<0.010	NA	<0.010	NA	<0.010	NA
	Mercury (MCL = 0.0002)	(mg/L)	<0.00020	NA	<0.00020	NA	<0.00020	NA
	Molybdenum	(mg/L)	<0.020	NA	<0.020	NA	<0.020	NA
	Nickel	(mg/L)	<0.020	NA	<0.020	NA	<0.020	NA
	Potassium	(mg/L)	<1.0	NA	<1.0	NA	0.25	NA
	Selenium (MCL = 0.05)	(mg/L)	<0.0050	NA	<0.0050	NA	<0.0050	NA
	Silicon	(mg/L)	0.09	NA	0.14	NA	3.40	NA
	Silver	(mg/L)	<0.030	NA	<0.030	NA	<0.030	NA
	Sodium	(mg/L)	0.13	NA	6.60	NA	3.00	NA
	Thallium (MCL = 0.002)	(mg/L)	<0.50	NA	<0.50	NA	<0.50	NA
	Tin	(mg/L)	<0.020	NA	<0.020	NA	<0.020	NA
	Titanium	(mg/L)	<0.020	NA	<0.020	NA	<0.020	NA
	Total Phosphorus	(mg/L)	<0.020	NA	<0.020	NA	<0.020	NA
	Vanadium	(mg/L)	<0.020	NA	<0.020	NA	<0.020	NA
	Zinc	(mg/L)	0.01	NA	<0.010	NA	0.01	NA

Ambient Groundwater Data

AMBIENT GROUNDWATER DATA, 2007

	Well Number:		BLNK-02		BLNK-01		G06151	
	Sample Date:		10/25/2007		10/23/2007		10/23/2007	
	Sample Type:		Total	Dissolved	Total	Dissolved	Total	Dissolved
Radionuclides	Tritium (MCL = 20,000)	(pCi/L)	<189	NA	<189	NA	<189	NA
	±2	(sigma)						
	Gross Alpha (MCL = 15)	(pCi/L)	<LLD	NA	<LLD	NA	<LLD	NA
	±2	(sigma)						
	LLD	(pCi/L)	2.09		2.09		2.19	
	Gross Non-volatile Beta (MCL = 8)	(pCi/L)	<LLD	NA	<LLD	NA	<LLD	NA
	±2	(sigma)						
	LLD	(pCi/L)	2.79		2.79		2.81	
	Beryllium-7	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	pCi/L)	21.50		19.45		19.59	
	Sodium-22	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.79		1.68		2.06	
	Potassium-40	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	27.90		28.45		27.69	
	Manganese-54	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.81		1.75		1.85	
	Cobalt-58	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	2.20		1.95		2.28	
	Cobalt-60	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.73		1.66		1.78	
	Zinc-65	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.89		3.47		3.83	
	Yitrium-88	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.89		1.88		2.14	
	Zirconium-95	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.28		3.64		3.65	
	Ruthenium-103	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	2.81		2.48		2.69	
	Antimony-125	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	5.02		4.73		4.97	
	Iodine-131	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	29.01		14.83		15.13	
	Cesium-134	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.46		1.70		1.65	
	Cesium-137	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	2.00		2.02		1.86	

Ambient Groundwater Data

AMBIENT GROUNDWATER DATA, 2007

	Well Number:		BLNK-02		BLNK-01		G06151	
	Sample Date:		10/25/2007		10/23/2007		10/23/2007	
	Sample Type:		Total	Dissolved	Total	Dissolved	Total	Dissolved
Radionuclides	Cerium-144	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	15.41		15.29		16.22	
	Europium-152	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	5.52		5.77		5.21	
	Europium-154	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	4.16		4.25		4.10	
	Europium-155	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	7.20		7.21		7.69	
	Lead-212	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.98		3.83		4.03	
	Lead-214	(pCi/L)	8.29	NA	<MDA	NA	<MDA	NA
	±2	(sigma)	3.22					
	MDA	(pCi/L)	3.85		4.98		5.56	
	Radium-226	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	54.32		53.93		43.88	
	Actinium-228	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	8.59		8.50		8.30	
	Thorium-234	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	51.25		52.57		52.50	
	Americium-241	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	12.38		13.14		12.69	

Ambient Groundwater Data

AMBIENT GROUNDWATER DATA, 2007

	Well Number:		GWELGIN		GWEASTOVER		GWELLOREE	
	Sample Date:		03/01/2007		03/01/2007		03/01/2007	
	Sample Type:		Total	Dissolved	Total	Dissolved	Total	Dissolved
Radionuclides	Tritium (MCL = 20,000)	(pCi/L)	<198	NA	<198	NA	<198	NA
	±2	(sigma)						
	Gross Alpha (MCL = 15)	(pCi/L)	7.75E+00	NA	<LLD	NA	<LLD	NA
	±2	(sigma)	1.82E+00					
	LLD	(pCi/L)	1.87E+00		1.89E+00		2.84E+00	
	Gross Non-volatile Beta (MCL = 8)	(pCi/L)	<LLD	NA	<LLD	NA	<LLD	NA
	±2	(sigma)	NA					
	LLD	(pCi/L)	2.80E+00		2.80E+00		2.86E+00	
	Beryllium-7	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	pCi/L)	4.87E+01		4.73E+01		4.65E+01	
	Sodium-22	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.08E+00		2.70E+00		2.96E+00	
	Potassium-40	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	2.82E+01		7.26E+01		7.33E+01	
	Manganese-54	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.38E+00		3.06E+00		3.29E+00	
	Cobalt-58	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	4.04E+00		3.96E+00		4.09E+00	
	Cobalt-60	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	2.75E+00		2.89E+00		2.84E+00	
	Zinc-65	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	6.93E+00		6.42E+00		6.53E+00	
	Yitrium-88	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	2.95E+00		3.11E+00		3.18E+00	
	Zirconium-95	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	7.89E+00		7.30E+00		7.93E+00	
	Ruthenium-103	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	6.76E+00		6.42E+00		6.16E+00	
	Antimony-125	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.05E+01		1.04E+01		1.03E+01	
	Iodine-131	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.03E+02		1.08E+02		1.02E+02	
	Cesium-134	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.08E+00		3.15E+00		3.01E+00	
	Cesium-137	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.41E+00		3.31E+00		3.32E+00	
	Cerium-144	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.86E+01		3.83E+01		3.66E+01	
	Europium-152	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.15E+01		1.15E+01		1.09E+01	
	Europium-154	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	8.49E+00		7.44E+00		8.19E+00	
	Europium-155	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.77E+01		1.71E+01		1.72E+01	
	Lead-212	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	8.19E+00		8.13E+00		7.77E+00	
	Lead-214	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	8.85E+00		8.43E+00		8.30E+00	

Ambient Groundwater Data

AMBIENT GROUNDWATER DATA, 2007

	Well Number:		GWELGIN		GWEASTOVER		GWELLOREE	
	Sample Date:		03/01/2007		03/01/2007		03/01/2007	
	Sample Type:		Total	Dissolved	Total	Dissolved	Total	Dissolved
Radionuclides	Radium-226	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.08E+02		1.04E+02		1.04E+02	
	Actinium-228	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.56E+01		1.44E+01		1.36E+01	
	Thorium-234	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.01E+02		1.03E+02		9.88E+01	
	Americium-241	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.59E+01		3.67E+01		3.47E+01	

Ambient Groundwater Data

AMBIENT GROUNDWATER DATA, 2007

	Well Number:		Beech Island		Jackson		Williston	
	Sample Date:		03/20/2007		03/20/2007		03/20/2007	
	Sample Type:		Total	Dissolved	Total	Dissolved	Total	Dissolved
Radionuclides	Tritium (MCL = 20,000)	(pCi/L)	<198	NA	<198	NA	<198	NA
	±2	(sigma)						
	Gross Alpha (MCL = 15)	(pCi/L)	<LLD	NA	<LLD	NA	1.89E+00	NA
	±2	(sigma)					1.19	
	LLD	(pCi/L)	1.71E+00		1.72E+00		1.76E+00	
	Gross Non-volatile Beta (MCL = 8)	(pCi/L)	<LLD	NA	<LLD	NA	<LLD	NA
	±2	(sigma)	NA					
	LLD	(pCi/L)	3.87E+00		3.87E+00		3.88E+00	
	Beryllium-7	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	pCi/L)	3.41E+01		3.45E+01		3.50E+01	
	Sodium-22	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	2.55E+00		2.59E+00		2.80E+00	
	Potassium-40	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	7.52E+01		7.66E+01		7.59E+01	
	Manganese-54	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.02E+00		3.12E+00		2.98E+00	
	Cobalt-58	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.22E+00		3.18E+00		3.48E+00	
	Cobalt-60	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	2.79E+00		2.49E+00		2.85E+00	
	Zinc-65	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	6.23E+00		6.46E+00		6.56E+00	
	Yitrium-88	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	2.57E+00		2.54E+00		2.47E+00	
	Zirconium-95	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	6.13E+00		6.21E+00		6.40E+00	
	Ruthenium-103	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	4.18E+00		4.25E+00		4.42E+00	
	Antimony-125	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.01E+01		9.73E+00		9.92E+00	
	Iodine-131	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.29E+01		1.47E+01		1.45E+01	
	Cesium-134	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.20E+00		3.17E+00		3.09E+00	
	Cesium-137	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.46E+00		3.34E+00		3.30E+00	
	Cerium-144	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.73E+01		3.67E+01		3.69E+01	
	Europium-152	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.16E+01		1.16E+01		1.15E+01	
	Europium-154	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	7.11E+00		7.20E+00		7.83E+00	
	Europium-155	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.69E+01		1.69E+01		1.72E+01	
	Lead-212	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	8.13E+00		8.09E+00		8.30E+00	
	Lead-214	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	8.86E+00		8.97E+00		8.82E+00	

Ambient Groundwater Data

AMBIENT GROUNDWATER DATA, 2007

	Well Number:		Beech Island		Jackson		Williston	
	Sample Date:		03/20/2007		03/20/2007		03/20/2007	
	Sample Type:		Total	Dissolved	Total	Dissolved	Total	Dissolved
Radionuclides	Radium-226	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.07E+02		1.07E+02		1.07E+02	
	Actinium-228	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.50E+01		1.65E+01		1.40E+01	
	Thorium-234	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	9.91E+01		1.02E+02		9.98E+01	
	Americium-241	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.47E+01		3.59E+01		3.86E+01	

Ambient Groundwater Data

AMBIENT GROUNDWATER DATA, 2007

	Well Number:		Wagener		New Ellenton		Harleyville	
	Sample Date:		05/23/2007		05/23/2007		05/30/2007	
	Sample Type:		Total	Dissolved	Total	Dissolved	Total	Dissolved
Radionuclides	Tritium (MCL = 20,000)	(pCi/L)	<212	NA	<212	NA	<212	NA
	±2	(sigma)						
	Gross Alpha (MCL = 15)	(pCi/L)	<LLD	NA	<LLD	NA	<LLD	NA
	±2	(sigma)						
	LLD	(pCi/L)	1.90E+00		1.87E+00		5.17E+00	
	Gross Non-volatile Beta (MCL = 8)	(pCi/L)	<LLD	NA	<LLD	NA	<LLD	NA
	±2	(sigma)						
	LLD	(pCi/L)	3.92E+00		3.91E+00		4.29E+00	
	Beryllium-7	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	pCi/L)	3.48E+01		3.60E+01		3.23E+01	
	Sodium-22	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.40E+00		3.42E+00		3.06E+00	
	Potassium-40	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	5.12E+01		4.91E+01		5.53E+01	
	Manganese-54	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.47E+00		3.52E+00		3.39E+00	
	Cobalt-58	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.58E+00		3.99E+00		3.24E+00	
	Cobalt-60	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.06E+00		3.56E+00		2.94E+00	
	Zinc-65	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	7.76E+00		7.61E+00		5.71E+00	
	Yitrium-88	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.14E+00		3.54E+00		4.09E+00	
	Zirconium-95	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	7.28E+00		8.45E+00		6.24E+00	
	Ruthenium-103	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	4.67E+00		4.94E+00		3.96E+00	
	Antimony-125	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	8.94E+00		9.58E+00		8.64E+00	
	Iodine-131	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.95E+01		2.11E+01		1.15E+01	
	Cesium-134	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.46E+00		3.15E+00		3.46E+00	
	Cesium-137	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.85E+00		3.57E+00		3.93E+00	
	Cerium-144	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	2.49E+01		2.48E+01		2.58E+01	
	Europium-152	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	9.15E+00		9.23E+00		9.08E+00	
	Europium-154	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	6.25E+00		6.40E+00		6.17E+00	
	Europium-155	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	9.42E+00		9.16E+00		9.07E+00	
	Lead-212	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	4.35E+00		4.24E+00		4.39E+00	
	Lead-214	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	7.97E+00		7.66E+00		8.12E+00	

Ambient Groundwater Data

AMBIENT GROUNDWATER DATA, 2007

	Well Number:		Wagener		New Ellenton		Harleyville	
	Sample Date:		05/23/2007		05/23/2007		05/30/2007	
	Sample Type:		Total	Dissolved	Total	Dissolved	Total	Dissolved
Radionuclides	Radium-226	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	8.88E+01		8.99E+01		8.65E+01	
	Actinium-228	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.36E+01		1.42E+01		1.47E+01	
	Thorium-234	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	6.39E+01		6.25E+01		6.45E+01	
	Americium-241	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	8.43E+00		8.04E+00		8.10E+00	

Ambient Groundwater Data

AMBIENT GROUNDWATER DATA, 2007

	Well Number:		Summerton		Turbeville		Town of Ridgeland	
	Sample Date:		05/30/2007		05/30/2007		10/29/2007	
	Sample Type:		Total	Dissolved	Total	Dissolved	Total	Dissolved
Radionuclides	Tritium (MCL = 20,000)	(pCi/L)	<212	NA	<212	NA	<189	NA
	±2	(sigma)						
	Gross Alpha (MCL = 15)	(pCi/L)	<LLD	NA	9.04E+00	NA	<LLD	NA
	±2	(sigma)			2.32			
	LLD	(pCi/L)	3.53E+00		2.30E+00		4.46E+00	
	Gross Non-volatile Beta (MCL = 8)	(pCi/L)	<LLD	NA	<LLD	NA	<LLD	NA
	±2	(sigma)						
	LLD	(pCi/L)	4.17E+00		4.00E+00		3.04E+00	
	Beryllium-7	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	pCi/L)	3.12E+01		3.17E+01		1.81E+01	
	Sodium-22	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	2.82E+00		3.53E+00		1.62E+00	
	Potassium-40	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	5.57E+01		5.31E+01		3.10E+01	
	Manganese-54	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.62E+00		3.88E+00		1.80E+00	
	Cobalt-58	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.92E+00		3.98E+00		1.78E+00	
	Cobalt-60	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.42E+00		3.00E+00		1.58E+00	
	Zinc-65	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	7.01E+00		6.42E+00		3.73E+00	
	Yitrium-88	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	4.07E+00		3.28E+00		1.86E+00	
	Zirconium-95	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	6.05E+00		7.36E+00		3.36E+00	
	Ruthenium-103	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	4.13E+00		4.28E+00		2.10E+00	
	Antimony-125	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.01E+01		9.12E+00		5.20E+00	
	Iodine-131	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.19E+01		1.24E+01		7.96E+00	
	Cesium-134	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.35E+00		2.96E+00		1.78E+00	
	Cesium-137	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	3.60E+00		3.44E+00		1.83E+00	
	Cerium-144	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	2.50E+01		2.41E+01		1.61E+01	
	Europium-152	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	8.96E+00		8.77E+00		5.39E+00	
	Europium-154	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	6.35E+00		6.28E+00		4.06E+00	
	Europium-155	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	9.33E+00		8.90E+00		7.27E+00	
	Lead-212	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	4.50E+00		4.25E+00		3.89E+00	
	Lead-214	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	7.23E+00		7.58E+00		5.29E+00	

Ambient Groundwater Data

AMBIENT GROUNDWATER DATA, 2007

	Well Number:		Summerton		Turbeville		Town of Ridgeland	
	Sample Date:		05/30/2007		05/30/2007		10/29/2007	
	Sample Type:		Total	Dissolved	Total	Dissolved	Total	Dissolved
Radionuclides	Radium-226	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	8.85E+01		8.65E+01		5.31E+01	
	Actinium-228	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	1.40E+01		1.19E+01		7.78E+00	
	Thorium-234	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	6.28E+01		6.37E+01		5.32E+01	
	Americium-241	(pCi/L)	<MDA	NA	<MDA	NA	<MDA	NA
	±2	(sigma)						
	MDA	(pCi/L)	8.11E+00		8.05E+00		1.33E+01	

Ambient Groundwater Data

AMBIENT GROUNDWATER DATA, 2007

	Well Number:		Town of Walterboro		M06005		Gooding	
	Sample Date:		10/29/2007		06/14/2007		03/14/2007	
	Sample Type:		Total	Dissolved	Total	Dissolved	Total	Dissolved
Radionuclides	Tritium (MCL = 20,000)	(pCi/L)	<189	NA	NA	NA	<198	NA
	±2	(sigma)						
	Gross Alpha (MCL = 15)	(pCi/L)	<LLD	NA	3.57E+00	NA	<LLD	NA
	±2	(sigma)			1.8			
	LLD	(pCi/L)	4.69E+00		2.51E+00		3.32E+00	
	Gross Non-volatile Beta (MCL = 8)	(pCi/L)	3.37E+00	NA	<LLD	NA	<LLD	NA
	±2	(sigma)	1.73					
	LLD	(pCi/L)	3.05E+00		3.51E+00		3.83E+00	
	Beryllium-7	(pCi/L)	<MDA	NA				
	±2	(sigma)						
	MDA	pCi/L)	1.79E+01					
	Sodium-22	(pCi/L)	<MDA	NA				
	±2	(sigma)						
	MDA	(pCi/L)	1.68E+00					
	Potassium-40	(pCi/L)	5.19E+01	NA				
	±2	(sigma)	1.85E+01					
	MDA	(pCi/L)	1.71E+01					
	Manganese-54	(pCi/L)	<MDA	NA				
	±2	(sigma)						
	MDA	(pCi/L)	1.68E+00					
	Cobalt-58	(pCi/L)	<MDA	NA				
	±2	(sigma)						
	MDA	(pCi/L)	1.87E+00					
	Cobalt-60	(pCi/L)	<MDA	NA				
	±2	(sigma)						
	MDA	(pCi/L)	1.45E+00					
	Zinc-65	(pCi/L)	<MDA	NA				
	±2	(sigma)						
	MDA	(pCi/L)	2.88E+00					
	Yitrium-88	(pCi/L)	<MDA	NA				
	±2	(sigma)						
	MDA	(pCi/L)	1.71E+00					
	Zirconium-95	(pCi/L)	<MDA	NA				
	±2	(sigma)						
	MDA	(pCi/L)	3.43E+00					
	Ruthenium-103	(pCi/L)	<MDA	NA				
	±2	(sigma)						
	MDA	(pCi/L)	2.26E+00					
	Antimony-125	(pCi/L)	<MDA	NA				
	±2	(sigma)						
	MDA	(pCi/L)	5.29E+00					
	Iodine-131	(pCi/L)	<MDA	NA				
	±2	(sigma)						
	MDA	(pCi/L)	8.56E+00					
	Cesium-134	(pCi/L)	<MDA	NA				
	±2	(sigma)						
	MDA	(pCi/L)	1.70E+00					
	Cesium-137	(pCi/L)	<MDA	NA				
	±2	(sigma)						
	MDA	(pCi/L)	1.90E+00					
	Cerium-144	(pCi/L)	<MDA	NA				
	±2	(sigma)						
	MDA	(pCi/L)	1.57E+01					
	Europium-152	(pCi/L)	<MDA	NA				
	±2	(sigma)						
	MDA	(pCi/L)	5.56E+00					
	Europium-154	(pCi/L)	<MDA	NA				
	±2	(sigma)						
	MDA	(pCi/L)	3.90E+00					
	Europium-155	(pCi/L)	<MDA	NA				
	±2	(sigma)						
	MDA	(pCi/L)	7.45E+00					
	Lead-212	(pCi/L)	<MDA	NA				
	±2	(sigma)						
	MDA	(pCi/L)	3.77E+00					
	Lead-214	(pCi/L)	<MDA	NA				
	±2	(sigma)						
	MDA	(pCi/L)	5.33E+00					

Ambient Groundwater Data

AMBIENT GROUNDWATER DATA, 2007

	Well Number:		Town of Walterboro		M06005		Gooding	
	Sample Date:		10/29/2007		06/14/2007		03/14/2007	
	Sample Type:		Total	Dissolved	Total	Dissolved	Total	Dissolved
Radionuclides	Radium-226	(pCi/L)	<MDA	NA	4.700E-01	NA		
	±2	(sigma)			1.700E-01			
	MDA	(pCi/L)	4.14E+01		2.100E-01			
	Actinium-228	(pCi/L)	<MDA	NA	2.000E-01	NA		
	±2	(sigma)			2.300E-01			
	MDA	(pCi/L)	7.34E+00		6.300E-01			
	Thorium-234	(pCi/L)	<MDA	NA				
	±2	(sigma)						
	MDA	(pCi/L)	5.21E+01					
	Americium-241	(pCi/L)	<MDA	NA				
	±2	(sigma)						
	MDA	(pCi/L)	1.22E+01					

Ambient Groundwater Data

AMBIENT GROUNDWATER DATA, 2007

Well Number:			Town of Ridgeland	Town of Walterboro	GWBLNK-01
Sample Date:			10/29/2007	10/29/2007	10/23/2007
Field Measurements	Temperature	(C)			
	pH	(S.U.)			
	Conductivity	(mS/cm)			
	Dissolved Oxygen	(mg/L)			
	Turbidity	(NTU)			
	Background Radiation	(uR/hr)			
	Sample Radiation	(uR/hr)			
Radionuclides	Total Uranium	(pCi/L)	<MDA	<MDA	<MDA
	±2	(sigma)	0.451	0.539	0.482
	MDA	(pCi/L)	0.833	0.833	0.833
	Radium-226	(pCi/L)	<LLD	<LLD	<LLD
	±2	(sigma)	0.162	0.154	0.162
	LLD	(pCi/L)	0.366	0.347	0.312
	Radium-228	(pCi/L)	<LLD	<LLD	<LLD
	±2	(sigma)	0.230	0.192	0.252
	LLD	(pCi/L)	0.716	0.593	0.730

Notes: 1. Shaded boxes indicate no data available.

AMBIENT GROUNDWATER DATA, 2007

Well Number:			GWG06151	GWG03121	GWDUP-01
Sample Date:			10/23/2007	10/23/2007	10/23/2007
Field Measurements	Temperature	(C)			
	pH	(S.U.)			
	Conductivity	(mS/cm)			
	Dissolved Oxygen	(mg/L)			
	Turbidity	(NTU)			
	Background Radiation	(uR/hr)			
	Sample Radiation	(uR/hr)			
Radionuclides	Total Uranium	(pCi/L)	<MDA	<MDA	<MDA
	±2	(sigma)	0.417	0.341	0.539
	MDA	(pCi/L)	0.833	0.833	0.833
	Radium-226	(pCi/L)	**0.509**	**0.484**	**0.430**
	±2	(sigma)	0.228	0.211	0.205
	LLD	(pCi/L)	0.316	0.289	0.289
	Radium-228	(pCi/L)	<LLD	<LLD	<LLD
	±2	(sigma)	0.246	0.274	0.292
	LLD	(pCi/L)	0.624	0.710	0.880

Notes: 1. Shaded boxes indicate no data available.

Ambient Groundwater Data

AMBIENT GROUNDWATER DATA, 2007

	Well Number:		GWD03010	GWG06126	GWG03102
	Sample Date:		10/24/2007	10/24/2007	10/25/2007
Field Measurements	Temperature	(C)			
	pH	(S.U.)			
	Conductivity	(mS/cm)			
	Dissolved Oxygen	(mg/L)			
	Turbidity	(NTU)			
	Background Radiation	(uR/hr)			
	Sample Radiation	(uR/hr)			
Radionuclides	Total Uranium	(pCi/L)	<MDA	<MDA	<MDA
	±2	(sigma)	0.417	0.565	0.451
	MDA	(pCi/L)	0.833	0.833	0.833
	Radium-226	(pCi/L)	<LLD	<LLD	<LLD
	±2	(sigma)	0.170	0.195	0.144
	LLD	(pCi/L)	0.286	0.338	0.316
	Radium-228	(pCi/L)	<LLD	<LLD	<LLD
	±2	(sigma)	0.244	0.251	0.245
	LLD	(pCi/L)	0.814	0.849	0.854

Notes: 1. Shaded boxes indicate no data available.

AMBIENT GROUNDWATER DATA, 2007

	Well Number:		GWG03103	GWBLNK-02	Town of Eastover
	Sample Date:		10/25/2007	10/25/2007	11/01/2007
Field Measurements	Temperature	(C)			
	pH	(S.U.)			
	Conductivity	(mS/cm)			
	Dissolved Oxygen	(mg/L)			
	Turbidity	(NTU)			
	Background Radiation	(uR/hr)			
	Sample Radiation	(uR/hr)			
Radionuclides	Total Uranium	(pCi/L)	<MDA	<MDA	
	±2	(sigma)	0.511	0.482	
	MDA	(pCi/L)	0.833	0.833	
	Radium-226	(pCi/L)	<LLD	<LLD	**1.720**
	±2	(sigma)	0.149	0.170	0.319
	LLD	(pCi/L)	0.304	0.348	0.274
	Radium-228	(pCi/L)	<LLD	<LLD	
	±2	(sigma)	0.225	0.241	
	LLD	(pCi/L)	0.805	0.689	

Notes: 1. Shaded boxes indicate no data available.

Back to List of Data Tables

2.1.5 Summary Statistics

Ambient Groundwater Monitoring Adjacent to SRS

Radionuclide Statistical Data for 2007 58

Notes: 1. N/A = Not Applicable

Back to List of Statistical Summaries

Summary Statistics
Ambient Groundwater

Lab Sample ID	Location Description	Well Designation	Alpha pCi/L	Ra 226 pCi/L	Beta pCi/L
XA09255	GWElgin	Non Random Background	**7.75**	<MDA	<LLD
XA11494	Town of Elgin	Non Random Background	<LLD	**1.19**	<LLD
XA10123	Turbeville	Random Background	**9.04**	<MDA	<LLD
XA10445	M06005	Random Perimeter	**3.57**	**0.47**	<LLD
XA10828	Town of Wagener	Random Perimeter	<LLD	**0.32**	<LLD
XA10829	Town of Williston	Random Perimeter	**1.89**	<MDA	<LLD
XA10830	Town of New Ellenton	Random Perimeter	<LLD	**0.51**	<LLD
XA10831	Town of Jackson	Random Perimeter	<LLD	**0.36**	<LLD
XA10832	Beech Island	Random Perimeter	<LLD	**0.58**	<LLD
XA11404	Town of Walterboro	Random Background	<LLD	<MDA	**3.37**
XA11406	GWG06151	Perimeter	<LLD	**0.51**	<LLD
XA11407	GWG03121	Perimeter	<LLD	**0.48**	<LLD
XA11495	Town of Eastover	Non Random Background	<LLD	**1.72**	<LLD
XA11496	Town of Elloree	Non Random Background	<LLD	**0.31**	<LLD

Random Perimeter			
	Mean	Std Dev.	Median
Alpha	**2.73**	**0.84**	**2.73**
Ra 226	**0.45**	**0.09**	**0.47**
Beta	**N/A**	**N/A**	**N/A**

Random Background			
	Mean	Std Dev.	Median
Alpha	**9.04**	**0**	**9.04**
Ra 226	**N/A**	**N/A**	**N/A**
Beta	**3.37**	**0**	**3.37**

Perimeter			
	Mean	Std Dev.	Median
Alpha	**N/A**	**N/A**	**N/A**
Ra 226	**0.49**	**0.01**	**0.49**
Beta	**N/A**	**N/A**	**N/A**

Non Random Background			
	Mean	Std Dev.	Median
Alpha	**7.75**	**0**	**7.75**
Ra 226	**1.07**	**0.58**	**1.19**
Beta	**N/A**	**N/A**	**N/A**

Back to List of Statistical Summaries

2.2 Drinking Water Quality Monitoring

2.2.1 Summary

The Environmental Surveillance and Oversight Program (ESOP) Drinking Water Monitoring Project, as part of South Carolina Department of Health and Environmental Control (SCDHEC), evaluates drinking water quality. ESOP provides assurance to the public that community drinking water systems adjacent and downstream to the Savannah River Site (SRS) have not been impacted by radiological constituents. The project objectives are to collect monthly composite surface water samples from water treatment plants using the lower portion of the Savannah River, and to collect semi-annual grab samples from selected community drinking water systems within 30 miles of SRS. SCDHEC analyzes samples for gross alpha, non-volatile beta, gamma-emitting radionuclides, and tritium. ESOP also provides analytical data from this project for comparison to published Department of Energy-Savannah River (DOE-SR) data.

The study area was established as a 30-mile radius circle centered in SRS. Using SCDHEC geographical information system, 18 groundwater fed and four surface water fed community drinking water systems were selected. These systems serve approximately 285,000 customers with approximately 109,000 receiving their water from groundwater sources (Table 1, Section 2.2.3). During 2007, DOE-SR collected water samples from four surface water locations (WSRC 2008a) that are colocated with the ESOP surface water fed drinking water systems.

Historically, tritium has been the main environmental release due to operations at Savannah River Site (SRS). Tritium was produced as a nuclear weapon enhancement component. The majority of tritium releases came from the production reactors, and the separation areas (CDC 2001). In addition to SRS activities, tritium can be attributed to atmospheric fallout from the nuclear facilities within close proximity of the study area.

Tritium oxide, the form of most concern, is generally indistinguishable from normal water and can move rapidly through the environment in the same manner as water. Tritium is naturally present in surface waters at about 10 to 30 picocuries per liter (pCi/L). The maximum contaminant level (MCL) developed by the United States Environmental Protection Agency (USEPA) for tritium in drinking water supplies is 20,000 pCi/L (ANL 2005). Tritium continues to be the most abundant radionuclide detected in public drinking water in the study area. Detected in both groundwater and surface water systems, the ESOP tritium detectable average was 227 picocuries per liter (pCi/L) for groundwater systems and 373.43 pCi/L for surface water systems. The DOE-SR detectable average for surface water systems was 259.97 pCi/L (WSRC 2008a). These tritium activities, however, were quite low when compared to the USEPA drinking water MCL (USEPA 2002a).

Man-made gamma-emitting radionuclides, such as Iodine-131, Cesium-137, and Cobalt-60, were products of SRS activities. These radionuclides were produced by fission in reactor fuels. They were primarily released in surface streams in the 1960s, or into the atmosphere in the separation areas (CDC 2001; WSRC 1998). These gamma-emitting radionuclides of concern were not detected above the Minimum Detectable Activity (MDA) in ESOP or DOE-SR 2007 samples (WSRC 2008a). Alpha emitting radionuclides, such as those emitted by plutonium and uranium,

were released by SRS primarily in the fuel fabrication facility in M-area, the reactors, and reprocessing areas (CDC 2001). Beta-emitting radionuclides were products of fission at SRS and were released primarily in the separation facilities (CDC 2001). All ESOP and DOE gross alpha and non-volatile beta detections were below the USEPA MCL of 15 pCi/L or 8 pCi/L, respectively (USEPA 2002a and WSRC 2008a). There were no detectable gamma-emitting radionuclides of concern found in either surface water or groundwater systems in 2007. There have been no detections of gamma-emitting radionuclides since ESOP began testing drinking water in 2002.

The SCDHEC Drinking Water Monitoring Project continues to be an important source of essential data for assessing human health exposure pathways. SCDHEC will continue sampling to provide the public with an independent source of radiological data for drinking water systems within the SRS study area.

RESULTS AND DISCUSSION

Surface Water Results

Tritium

The primary tritium releases originated from processes associated with the reactors (R, P, K, L, and C), separation facilities (F-Area and H-Area), the heavy water facility (D-Area), and tritium recovery in the tritium facilities. The two main types of tritium releases come from direct releases from site facilities and migration from seepage basins in F-Area and H-Area, the burial ground, and the K-Area containment basin. In the early operational years, almost 100% of the releases to streams was related to direct releases. After the cessation of operational activities, most releases were a result of migration from the seepage basins. Since the mid 1970s, migration and outcropping to streams have accounted for most of the SRS tritium released to surface water (Till et al. 2001). After 1988, the Effluent Treatment Facility (ETF) went into operation and the F-Area and H-Area basins were not used (CDC 2006). Periodically, ETF has controlled tritium releases to Upper Three Runs.

Based on a review of the surface water data from the Savannah River, tritium was detected above the Lower Limit of Detection (LLD) in all surface water composites (Figure 1, Section 2.2.3). Detectable tritium activity in these samples had an average of 373.43 (± 71.34) pCi/L and ranged from 135 to 706 pCi/L (Section 7). This is a reduction from 2006 where tritium detections averaged 455.16 (± 144.7) pCi/L (ESOP 2006). These tritium activities are measurable but not significant when compared with the 20,000 pCi/L USEPA MCL (USEPA 2002a). Of the 12 background North Augusta surface water composites; there were five detections above the LLD. Tritium activity in the North Augusta samples ranged from 135 to 486 pCi/L and averaged 268.20 (± 133.96) pCi/L. Tritium activity in the three downstream intakes, Beaufort/Jasper Chelsea Plant, Beaufort/Jasper Purrysburg Plant, and City of Savannah samples had a range of 216 to 706 and averaged 408.50 (± 15.86) pCi/L. The detectable tritium in the background surface water location was within two standard deviations of the downstream locations. Section 2.2.3 summarizes the tritium activities for the surface water composites as well as trending data for surface water fed systems over the past seven years.

Gamma-emitting Radionuclides

Gamma-emitting radionuclides of concern were not detected above the MDA and have not been detected for any of the surface water samples collected by ESOP since 2002. No summary statistics were calculated for gamma-emitting radionuclides.

Gross Alpha and Gross Non-volatile Beta

Gross alpha-emitting radionuclides were released to liquid effluent from the reactor materials area (M-area), separations areas (F- Area and H-area), and the reactor areas. The primary stream affected by the M-area releases was Tims Branch, which ultimately flows into Upper Three Runs. Fourmile Creek is the stream most affected by releases coming from the separation areas. Releases from the reactor areas affected all streams with the exception of Upper Three Runs (Till et al. 2001). Gross beta-emitting radionuclides were released to liquid effluent from separations areas (F-Area and H-area). The stream primarily affected by these releases was Fourmile Creek (Till et al. 2001).

Gross alpha and gross non-volatile beta were detected in both background and perimeter locations. The North Augusta and City of Savannah locations had gross alpha detections which averaged 3.22 (± 1.19) pCi/L and ranged from 1.89 to 6.24 pCi/L (Section 2.2.5). Gross non-volatile beta was detected in three of the four surface water locations including North Augusta and both Beaufort/ Jasper surface water intakes. The yearly detectable average was 4.56 (± 1.45) pCi/L and ranged from 3.56 to 7.66 pCi/L (Section 2.2.5). Speciation is not done for gross alpha or non-volatile beta unless there is detection above the USEPA MCL of 15 pCi/L or 8 pCi/L respectively (USEPA 2002a). Alpha and beta activity is likely attributable to naturally occurring radionuclides.

Groundwater System Results

Tritium

Based on a review of the analytical data, six of the 18 groundwater fed systems sampled had tritium activities above the LLD. The detected tritium activities ranged from 177 to 302 pCi/L with an average of 227 (± 44.54) pCi/L (Section 2.2.5). This is a reduction from 2006 where tritium detections averaged 265.50 (± 53.39) pCi/L (SCDHEC 2006a). These tritium activities are measurable but not significant when compared to the 20,000 pCi/L USEPA MCL (USEPA 2002a). Figure 2, Section 2.2.3 shows trending data from the past five years for the samples from groundwater fed systems that showed detections.

Gamma-emitting Radionuclides

Gamma-emitting radionuclides of concern were not detected above the MDA in any groundwater samples tested in the six years of testing by ESOP. No summary statistics were calculated for gamma-emitting radionuclides.

Gross Alpha and Non-volatile Beta

Gross alpha was detected in four of the 18 groundwater systems tested in 2007. The range for gross alpha detections was 2.17 to 4.32 pCi/L with an average activity of 2.93 (± 0.89) pCi/L. This is a reduction from 2006 where six systems had detections that averaged 3.63 (± 1.34) pCi/L (SCDHEC 2006a). All gross alpha samples were below the USEPA MCL of 15 pCi/L (USEPA 2002a). There were no detections for gross non-volatile beta in any of the groundwater systems tested. There were seven systems that detected non-volatile beta in 2006 averaging 3.24 (± 0.83) pCi/L (SCDHEC 2006a). Speciation is not conducted for gross alpha unless there is a detection above the USEPA MCL of 15 pCi/L. Summary Statistics for groundwater fed systems are located in the last two tables of Section 2.2.5.

Groundwater and Surface Water Statistical Comparison

The gross alpha detectable average was 2.93 (± 0.89) pCi/L for groundwater systems and 3.22 (± 1.19) pCi/L for surface water systems in 2007 (Section 2.2.5). The gross alpha detections of the groundwater systems are within one standard deviation of the surface water systems. Section 2.2.3 illustrates the trending data for all ESOP surface water and drinking water gross alpha detections over the last six years. Detections of gross alpha continue to be far lower than the USEPA MCL of 15 pCi/L (USEPA 2002a).

The non-volatile beta detectable average for surface water systems was 4.56 (± 1.45) pCi/L. There were no groundwater non-volatile beta detections in 2007. Figure 4, Section 2.2.3 shows surface water and drinking water trending data for all non-volatile beta detections since 2002. Non-volatile beta has continued to stay far below the USEPA MCL of 8 pCi/L (USEPA 2002a). The tritium detectable average was 227.0 (± 44.54) pCi/L for groundwater systems and 373.43 (± 71.34) pCi/L for surface water systems (Section 2.2.5). The detectable tritium in groundwater was within four standard deviations of the surface water systems. Section 2.2.3 illustrates surface water and drinking water tritium detections over the last six years. Surface water systems continue to have a higher tritium average compared to groundwater systems. These averages, however, have continued to be considerably lower than the USEPA MCL of 20,000 pCi/L (USEPA 2002a). Section 2.2.3 demonstrates an overall reduction in tritium levels over the past six years.

DOE-SR Data Comparison

DOE-SR conducts monthly composite sampling at the four water treatment plants that use Savannah River surface water to supply drinking water for the local population.

Based on the DOE-SR 2007 annual report, tritium in the three downstream water intakes averaged 292.07 (± 23.84) pCi/L and ranged from 153.0 to 632.0 pCi/L compared to ESOP downstream detections which averaged 408.50 (± 15.86) pCi/L and ranged 216 to 706 pCi/L (WSRC 2008a). Figure 6, Section 2.2.3 shows DOE-SR tritium detection averages over a six year time period. DOE-SR had an overall detected tritium average of 259.97 (± 67.08) pCi/L for all samples collected in 2007. This was lower than the ESOP detected tritium average of 373.43

(± 71.34) pCi/L for the same period (WSRC 2008a). All samples were lower than the USEPA MCL of 20,000 pCi/L (USEPA 2002a). Although tritium continues to be the most abundant radionuclide in the Savannah River, the tritium levels have been consistently decreasing over the past six years.

Gamma-emitting radionuclides were not detected in DOE-SR or ESOP samples in 2007. DOE-SR and ESOP detected non-volatile beta in surface water samples. The DOE-SR non-volatile beta average of 1.769 (± 0.139) pCi/L was more than 5 standard deviations lower than the ESOP detectable average of 4.56 (± 1.45) pCi/L (WSRC 2008a). This disparity could be explained due to the differences in the instruments. DOE-SR did not detect gross alpha in 2007 (WSRC 2008a). ESOP, however, had three surface water detections averaging 3.22 (± 1.19) pCi/L. All detections were under the established USEPA MCL for gross alpha and non-volatile beta in drinking water (USEPA 2002a).

CONCLUSIONS AND RECOMMENDATIONS

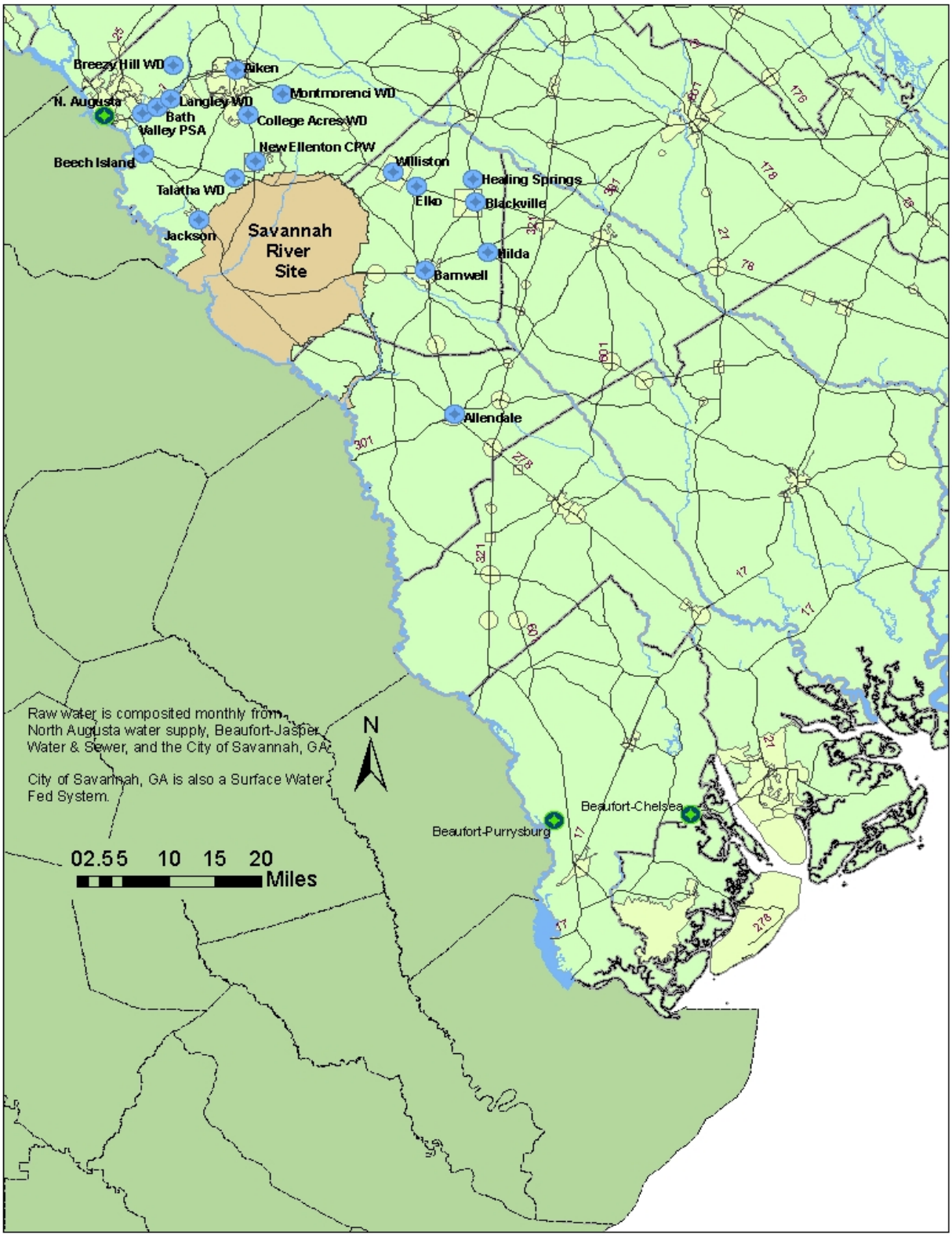
Tritium continues to be the most abundant radionuclide detected in public drinking water supplies potentially impacted by SRS. Tritium was detected in both groundwater and surface water systems. However, these tritium activities were low considering the USEPA 20,000 pCi/L MCL for drinking water. Detections of gross alpha, gross beta and gamma-emitting radionuclides of concern were all below their respective MCL's. Comparative analysis with DOE-SR for groundwater systems cannot be done, because DOE-SR does not sample systems off of the Savannah River Site.

SCDHEC will continue sampling to provide the public with an independent source of radiological data for surface water and groundwater water systems. Additional background samples will be taken in the future to give a better idea of what naturally occurring radioactivity levels are in South Carolina. The data from these samples will be used in statistical analysis with the routine samples.

Back to Table of Contents

2.2.2
Map 4. Drinking Water Monitoring Locations

Back to Maps



2.2.3 Tables and Figures

Drinking Water Quality Monitoring

Table 1. Drinking Water Systems Sampled by ESOP

System Number	System Name	Number of Taps	Population Served
210001	Aiken	18,298	42,028
210002	Jackson	1,289	3,602
210007	New Ellenton	2,221	5,303
220001	Langley Water District	335	838
220002	College Acres Public Water District	528	1,350
220003	Bath Water District	314	1,064
220004	Beech Island	3,062	7,436
220005	Talatha Water District	572	1,553
220006	Breezy Hill Water District	5,074	16,133
220008	Montmorenci Water District	1,311	3,198
220012	Valley Public Service Authority	3,365	8,724
310001	Allendale	1,521	4,052
610001	Barnwell	2,494	6,727
610002	Williston	1,629	3,307
610003	Blackville	1,139	2,973
610004	Hilda	131	466
610005	Elko	150	462
670075	Healing Springs	1	6*
0210003F	North Augusta Surface Water	11,301	29,493
0720003F	Chelsea B/J Plant Surface Water canal intake	42,877	135,755
0720004F	Purrysburg B/J Plant Surface Water SR intake		
SAVF	City of Savannah Surface Water (Industrial)	35	10,619
	TOTAL	97,647	285,083
	Approx. Groundwater	43,433	109,216
	Approx. Surface water	54,213	175,867

*This number is estimation due to public access to the natural spring.

Tables and Figures

Drinking Water Quality Monitoring

Figure 1. ESOP Yearly Tritium Averages in Surface Water Systems

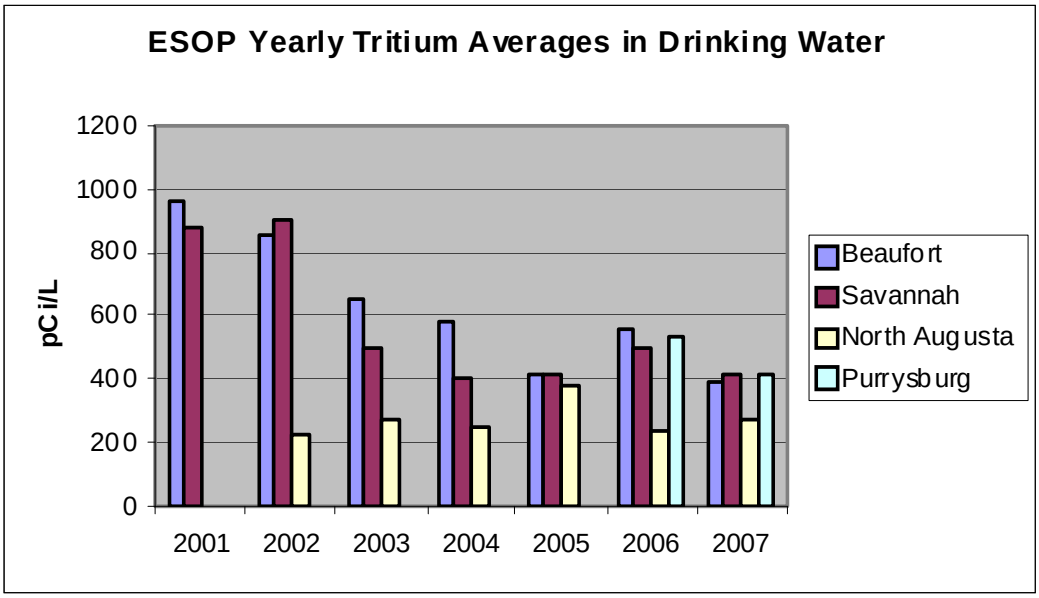
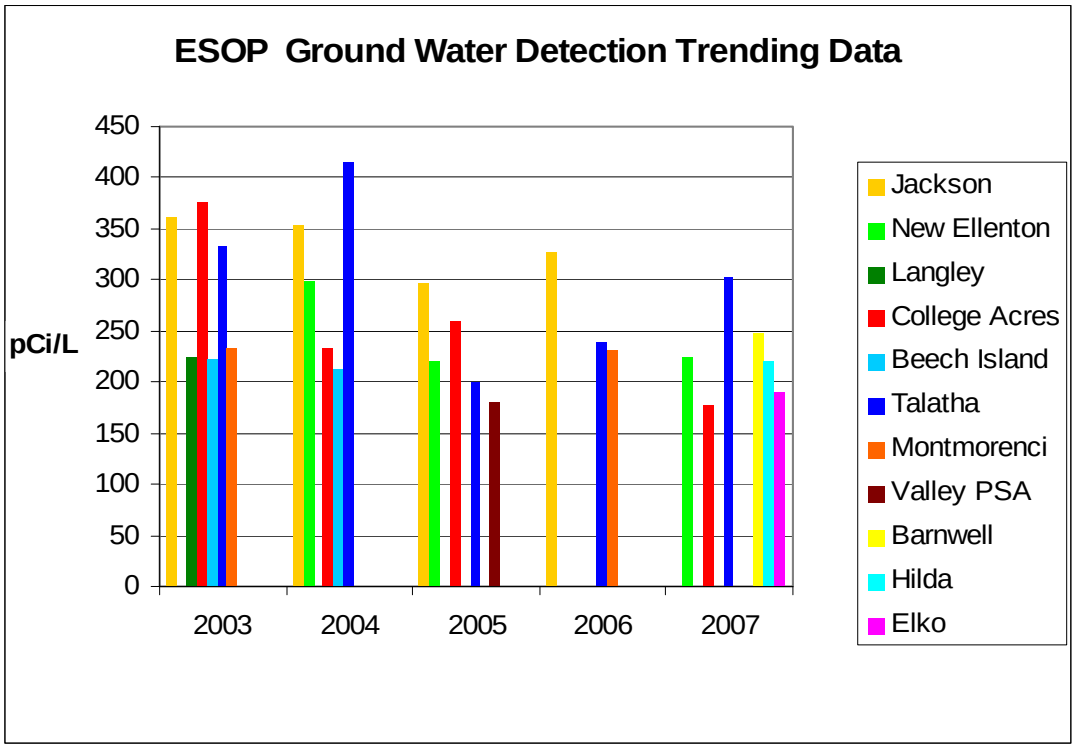


Figure 2. ESOP Yearly Tritium Averages for Ground Water System Detections



Tables and Figures

Drinking Water Quality Monitoring

Figure 3. ESOP Yearly Gross Alpha Detection Averages 2002-2007.

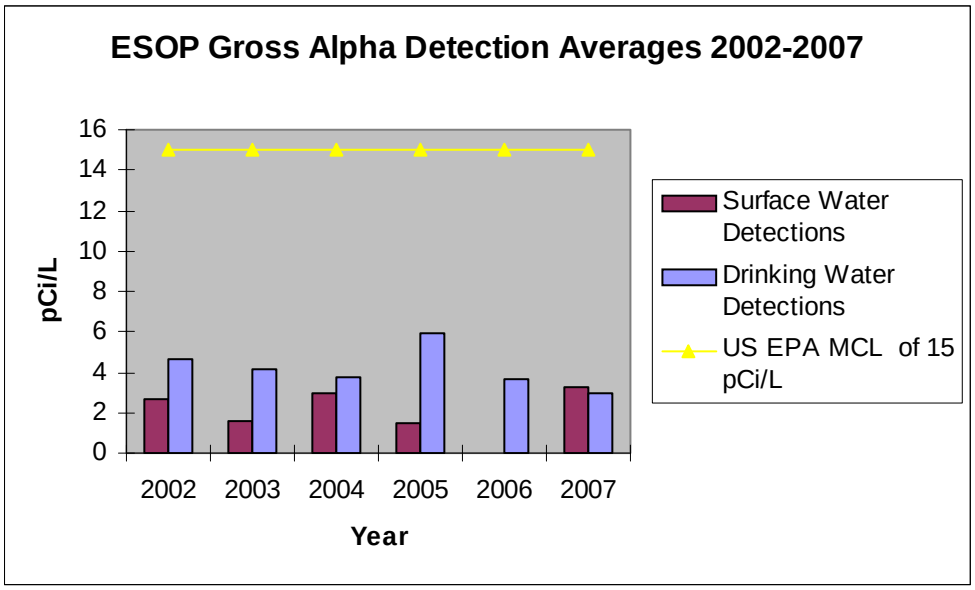
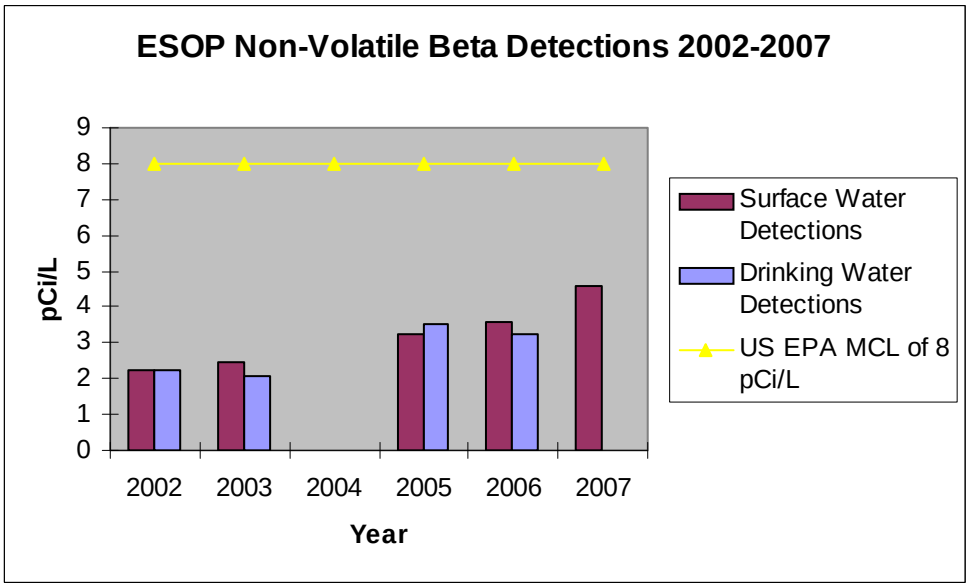


Figure 4. ESOP Yearly Non-Volatile Beta Detection Averages in 2002-2007



There were no non-volatile beta detections in 2004

Tables and Figures

Drinking Water Quality Monitoring

Figure 5. ESOP Yearly Tritium Averages in 2002-2007

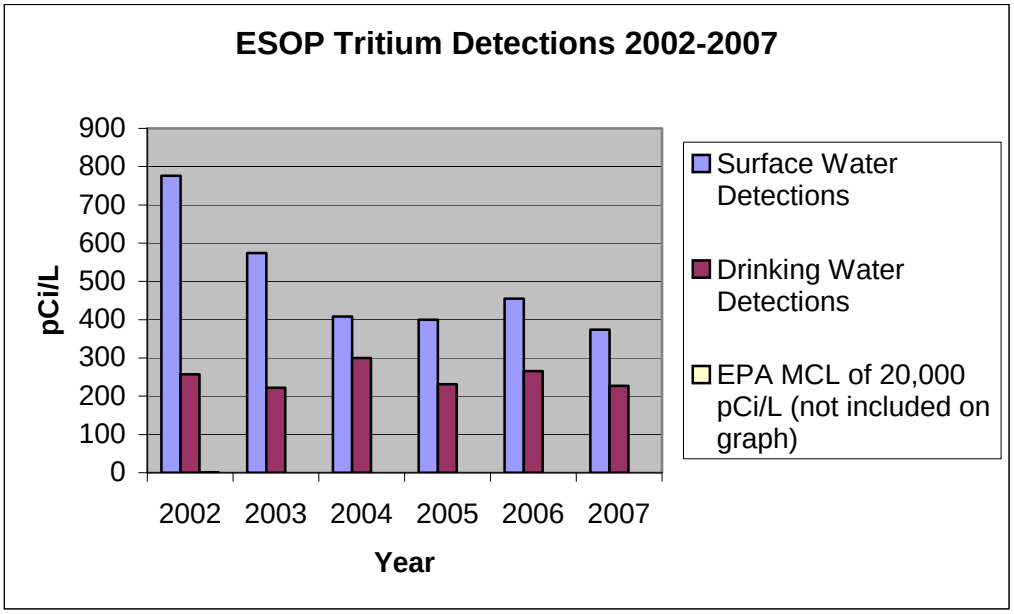
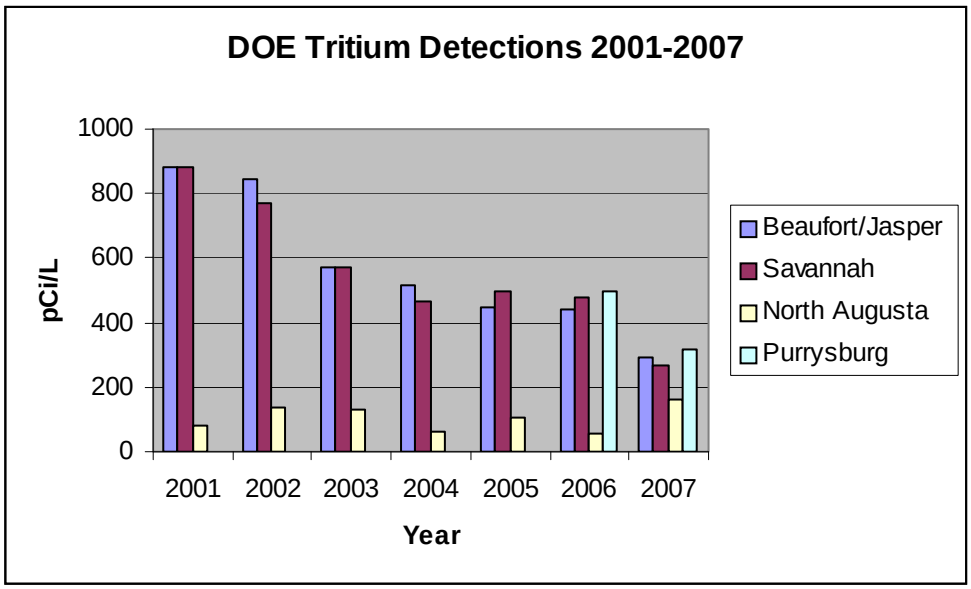


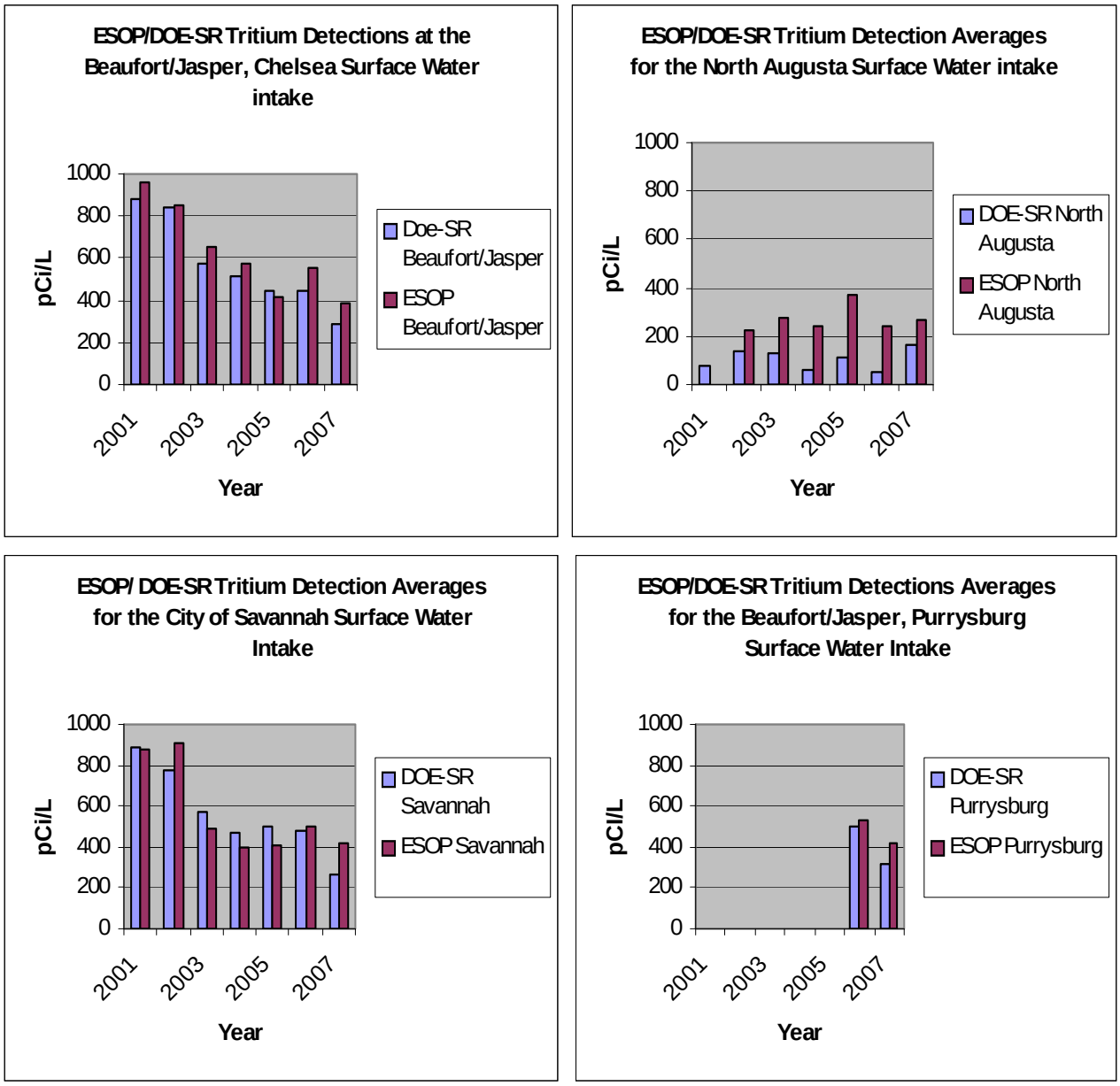
Figure 6. DOE-SR Yearly Tritium Averages in Drinking Water



Tables and Figures

Drinking Water Quality Monitoring

Figure 7. ESOP/DOE-SR Comparison of 2007 Averages of Tritium in Drinking Water



- **Purrysburg was first collected as a new sampling location in 2006**

Back to Tables and Figures

2.2.4 Data

Drinking Water Quality Monitoring

Data Summary of Surface Water Composites, 2007 71

Data Summary for Groundwater Fed Systems, 2007 75

Notes:
1. ±2 = 2 Standard Deviations
2. Detections are in Bold
3. Non-detect denotes <
4. N-V= Non-volatile Beta
5. < # is MDA

Back to List of Data Tables

Drinking Water Data

2007 DATA SUMMARY OF SURFACE WATER COMPOSITES

Sample Number:			DW0210003F			
Sample Name:			North Augusta Surface Water			
Date:			January-07	February-07	March-07	April-07
Radionuclides	Gross Alpha	(pCi/L)	<1.76	<1.74	<2.39	<2.30
	±2	(sigma)				
	N-V Beta	(pCi/L)	<3.93	<3.93	<3.50	<3.52
	±2	(sigma)				
	Tritium	(pCi/L)	<187	**135**	<194	**253**
	±2	(sigma)		**85**		**91**
	Cesium-137	(pCi/L)	<3.330	<3.856	<3.148	<2.017
	±2	(sigma)				

Sample Number:			DW0210003F			
Sample Name:			North Augusta Surface Water			
Date:			May-07	June-07	July-07	August-07
Radionuclides	Gross Alpha	(pCi/L)	<2.31	<2.58	**1.89**	<1.79
	±2	(sigma)			**1.28**	
	N-V Beta	(pCi/L)	**3.56**	<3.86	<3.67	<3.66
	±2	(sigma)	**1.94**			
	Tritium	(pCi/L)	<192	**278**	<180	**189**
	±2	(sigma)		**93**		**84**
	Cesium-137	(pCi/L)	<1.554	<1.856	<2.821	<2.977
	±2	(sigma)				

Sample Number:			DW0210003F			
Sample Name:			North Augusta Surface Water			
Date:			September-07	October-07	November-07	December-07
Radionuclides	Gross Alpha	(pCi/L)	<1.82	<2.57	<2.59	**6.24**
	±2	(sigma)				**2.06**
	N-V Beta	(pCi/L)	<3.67	<3.46	<3.46	<3.46
	±2	(sigma)				
	Tritium	(pCi/L)	<180	<197	<197	**486**
	±2	(sigma)				**103**
	Cesium-137	(pCi/L)	<3.053	<3.076	<2.342	<2.679
	±2	(sigma)				

Drinking Water Data

2007 DATA SUMMARY OF SURFACE WATER COMPOSITES

Sample Number:			DW0720003F			
Sample Name:			Chelsea B/J Surface Water Canal Intake			
Date:			January-07	February-07	March-07	April-07
Radionuclides	Gross Alpha	(pCi/L)	<1.90	<1.93	<2.59	<2.66
	±2	(sigma)				
	N-V Beta	(pCi/L)	**4**	<3.95	**3.92**	**3.74**
	±2	(sigma)	**2.16**		**3.53**	**1.97**
	Tritium	(pCi/L)	**434**	**375**	**403**	**547**
	±2	(sigma)	**97**	**95**	**99**	**103**
	Cesium-137	(pCi/L)	<3.400	<3.435	<2.929	<2.340
	±2	(sigma)				

Sample Number:			DW0720003F			
Sample Name:			Chelsea B/J Surface Water Canal Intake			
Date:			May-07	June-07	July-07	August-07
Radionuclides	Gross Alpha	(pCi/L)	<2.65	<2.95	<2.03	<2.09
	±2	(sigma)				
	N-V Beta	(pCi/L)	<3.57	<3.92	<3.71	<3.73
	±2	(sigma)				
	Tritium	(pCi/L)	**448**	**558**	<180	**236**
	±2	(sigma)	**99**	**104**		**86**
	Cesium-137	(pCi/L)	<1.809	<2.390	<3.052	<2.821
	±2	(sigma)				

Sample Number:			DW0720003F			
Sample Name:			Chelsea B/J Surface Water Canal Intake			
Date:			September-07	October-07	November-07	December-07
Radionuclides	Gross Alpha	(pCi/L)	<2.09	<3.05	<3.34	<2.99
	±2	(sigma)				
	N-V Beta	(pCi/L)	<3.72	<3.52	<3.56	<3.52
	±2	(sigma)				
	Tritium	(pCi/L)	**233**	**307**	**361**	<197
	±2	(sigma)	**86**	**96**	**98**	
	Cesium-137	(pCi/L)	<2.833	<2.701	<3.299	<2.812
	±2	(sigma)				

Drinking Water Data

2007 DATA SUMMARY OF SURFACE WATER COMPOSITES

Sample Number:			**DWSAVF**			
Sample Name:			**City of Savannah Surface Water (Industrial)**			
Date:			January-07	February-07	March-07	April-07
Radionuclides	Gross Alpha	(pCi/L)	<1.95	<1.77	<2.64	<2.71
	±2	(sigma)				
	N-V Beta	(pCi/L)	<3.95	<3.93	<3.57	<3.58
	±2	(sigma)				
	Tritium	(pCi/L)	**411**	**397**	**706**	**618**
	±2	(sigma)	**96**	**96**	**109**	**106**
	Cesium-137	(pCi/L)	<3.414	<3.643	<1.718	<1.861
	±2	(sigma)				

Sample Number:			**DWSAVF**			
Sample Name:			**City of Savannah Surface Water (Industrial)**			
Date:			May-07	June-07	July-07	August-07
Radionuclides	Gross Alpha	(pCi/L)	<2.68	<3.12	<2.10	**2.38**
	±2	(sigma)				**1.51**
	N-V Beta	(pCi/L)	<3.58	<3.94	<3.73	<3.73
	±2	(sigma)				
	Tritium	(pCi/L)	**345**	**296**	<180	**237**
	±2	(sigma)	**95**	**93**		**86**
	Cesium-137	(pCi/L)	<1.696	<1.890	<3.013	<2.508
	±2	(sigma)				

Sample Number:			**DWSAVF**			
Sample Name:			**City of Savannah Surface Water (Industrial)**			
Date:			September-07	October-07	November-07	December-07
Radionuclides	Gross Alpha	(pCi/L)	<2.16	<3.13	<3.05	<3.08
	±2	(sigma)				
	N-V Beta	(pCi/L)	<3.74	<3.53	<3.52	<2.68
	±2	(sigma)				
	Tritium	(pCi/L)	<180	**243**	<197	**511**
	±2	(sigma)		**93**		**104**
	Cesium-137	(pCi/L)	<2.921	<2.586	<2.954	<2.501
	±2	(sigma)				

Drinking Water Data

2007 DATA SUMMARY OF SURFACE WATER COMPOSITES

Sample Number:			DW0720004F			
Sample Name:			Purrysburg B/J Plant Surface Water SR intake			
Date:			January-07	February-07	March-07	April-07
Radionuclides	Gross Alpha	(pCi/L)	<1.89	<1.90	<2.59	<2.56
	±2	(sigma)				
	N-V Beta	(pCi/L)	<3.94	<3.95	<3.53	<3.56
	±2	(sigma)				
	Tritium	(pCi/L)	**337**	**429**	**655**	**679**
	±2	(sigma)	**93**	**97**	**108**	**108**
	Cesium-137	(pCi/L)	<3.418	<3.999	<2.689	<1.979
	±2	(sigma)				

Sample Number:			DW0720004F			
Sample Name:			Purrysburg B/J Plant Surface Water SR intake			
Date:			May-07	June-07	July-07	August-07
Radionuclides	Gross Alpha	(pCi/L)	<2.65	<2.97	<2.03	<2.02
	±2	(sigma)				
	N-V Beta	(pCi/L)	**7.66**	<3.92	<3.71	<3.71
	±2	(sigma)	**2.14**			
	Tritium	(pCi/L)	**480**	**567**	**301**	**297**
	±2	(sigma)	**101**	**104**	**89**	**89**
	Cesium-137	(pCi/L)	<1.589	<1.782	<2.692	<2.426
	±2	(sigma)				

Sample Number:			DW0720004F			
Sample Name:			Purrysburg B/J Plant Surface Water SR intake			
Date:			September-07	October-07	November-07	December-07
Radionuclides	Gross Alpha	(pCi/L)	<2.06	<2.93	<3.15	<3.07
	±2	(sigma)				
	N-V Beta	(pCi/L)	<3.72	<3.51	<3.54	**4.78**
	±2	(sigma)				**2**
	Tritium	(pCi/L)	**253**	**410**	**216**	**381**
	±2	(sigma)	**87**	**99**	**92**	**99**
	Cesium-137	(pCi/L)	<3.388	<2.766	<2.398	<2.495
	±2	(sigma)				

Drinking Water Data

2007 DATA SUMMARY OF GROUND WATER FED SYSTEMS

System Number:			**DW0210001**		**DW0210002**	
System Name:			**Aiken**		**Jackson**	
Date:			April-07	Oct.-07	April-07	Oct.-07
Radionuclides	Gross Alpha	(pCi/L)	<2.40	**2.25**	**4.12**	**4.32**
	±2	(sigma)		**1.36**	**2.25**	**1.87**
	N-V Beta	(pCi/L)	<3.50	<3.68	<3.47	<3.54
	±2	(sigma)				
	Tritium	(pCi/L)	<194	<180	<194	<164
	±2	(sigma)				
	Cesium-137	(pCi/L)	<3.079	<2.621	<2.989	<1.661
	±2	(sigma)				

System Number:			**DW670075**		**DW0210007**	
System Name:			**Healing Springs**		**New Ellenton**	
Date:			April-07	Oct.-07	April-07	Oct.-07
Radionuclides	Gross Alpha	(pCi/L)	<2.60	<4.16	<2.06	<2.27
	±2	(sigma)				
	N-V Beta	(pCi/L)	<4.07	<3.70	<3.44	<3.48
	±2	(sigma)				
	Tritium	(pCi/L)	<194	<164	<194	**224**
	±2	(sigma)				**80**
	Cesium-137	(pCi/L)	<3.442	<1.662	<3.187	<1.807
	±2	(sigma)				

System Number:			**DW0220001**		**DW0220002**	
System Name:			**Langley Water**		**College Acres**	
Date:			April-07	Oct.-07	April-07	Oct.-07
Radionuclides	Gross Alpha	(pCi/L)	**2.67**	**2.17**	**2.84**	<2.59
	±2	(sigma)	**2.07**	**1.19**	**1.48**	
	N-V Beta	(pCi/L)	<3.44	<3.60	<4.02	<3.54
	±2	(sigma)				
	Tritium	(pCi/L)	<194	<180	<194	**177**
	±2	(sigma)				**78**
	Cesium-137	(pCi/L)	<2.851	<2.607	<3.202	<1.655
	±2	(sigma)				

Drinking Water Data

2007 DATA SUMMARY OF GROUND WATER FED SYSTEMS

System Number:			**DW0220003**		**DW0220004**	
System Name:			**Bath Water Dist.**		**Beech Island**	
Date:			April-07	Oct.-07	April-07	Oct.-07
Radionuclides	Gross Alpha	(pCi/L)	<2.58	<2.92	<2.02	<2.50
	±2	(sigma)				
	N-V Beta	(pCi/L)	<3.52	<3.58	<4.01	<3.52
	±2	(sigma)				
	Tritium	(pCi/L)	<194	<164	<194	<164
	±2	(sigma)				
	Cesium-137	(pCi/L)	<2.777	<1.789	<3.405	<1.739
	±2	(sigma)				

System Number:			**DW0220005**		**DW0220006**	
System Name:			**Talatha Water**		**Breezy Hill**	
Date:			April-07	Oct.-07	April-07	Oct.-07
Radionuclides	Gross Alpha	(pCi/L)	<2.48	<2.73	<2.33	<1.75
	±2	(sigma)				
	N-V Beta	(pCi/L)	<3.51	<3.56	<3.49	<3.65
	±2	(sigma)				
	Tritium	(pCi/L)	<194	**302**	NS	<180
	±2	(sigma)		**84**		
	Cesium-137	(pCi/L)	<3.031	<1.914	<2.789	<3.060
	±2	(sigma)				

System Number:			**DW0220008**		**DW0220012**	
System Name:			**Montmorenci**		**Valley PSA**	
Date:			April-07	Oct.-07	April-07	Oct.-07
Radionuclides	Gross Alpha	(pCi/L)	<2.04	<2.61	<3.80	<4.16
	±2	(sigma)				
	N-V Beta	(pCi/L)	<4.01	<3.54	<3.65	<3.70
	±2	(sigma)				
	Tritium	(pCi/L)	<194	<164	<194	<164
	±2	(sigma)				
	Cesium-137	(pCi/L)	<3.193	<1.967	<3.013	<1.873
	±2	(sigma)				

Drinking Water Data

2007 DATA SUMMARY OF GROUND WATER FED SYSTEMS

System Number:			DW0310001		DW0610001	
System Name:			Allendale		Barnwell	
Date:			April-07	Oct.-07	April-07	Oct.-07
Radionuclides	Gross Alpha	(pCi/L)	<3.12	<5.39	<2.35	<3.17
	±2	(sigma)				
	N-V Beta	(pCi/L)	<4.11	<3.78	<4.04	<3.61
	±2	(sigma)				
	Tritium	(pCi/L)	<194	<164	<194	**248**
	±2	(sigma)				**81**
	Cesium-137	(pCi/L)	<3.186	<1.987	<3.527	<2.006
	±2	(sigma)				

System Number:			DW0610002		DW0610003	
System Name:			Williston		Blackville	
Date:			April-07	Oct.-07	April-07	Oct.-07
Radionuclides	Gross Alpha	(pCi/L)	<2.11	<2.72	<3.00	<5.10
	±2	(sigma)				
	N-V Beta	(pCi/L)	<4.02	<3.56	<4.10	<3.76
	±2	(sigma)				
	Tritium	(pCi/L)	<194	<164	<194	<164
	±2	(sigma)				
	Cesium-137	(pCi/L)	<3.160	<1.584	<3.381	<1.811
	±2	(sigma)				

System Number:			DW0610004		DW0610005	
System Name:			Hilda		Elko	
Date:			April-07	Oct.-07	April-07	Oct.-07
Radionuclides	Gross Alpha	(pCi/L)	<2.38	<2.76	<2.48	<3.72
	±2	(sigma)				
	N-V Beta	(pCi/L)	<4.05	<3.56	<4.06	<3.67
	±2	(sigma)				
	Tritium	(pCi/L)	<194	**220**	<194	**191**
	±2	(sigma)		**80**		**78**
	Cesium-137	(pCi/L)	<3.652	<1.693	<3.161	<1.873
	±2	(sigma)				

Back to List of Data Tables

2.2.5 Summary Statistics

Drinking Water Quality Monitoring

2007 Surface Water Statistics **79**

2007 Groundwater Statistics **80**

Back to List of Statistical Summaries

Summary Statistics

Drinking Water Quality Monitoring

Surface Water

Radionuclide:	Gross Alpha (pCi/L)	Statistical Analysis					
System Name:	System Number:	Median	Avg.	St. Dev.	Max	Min	Num
North Augusta SW	DW0210003F	4.07	4.07	3.08	6.24	1.89	2
City of Savannah	SAVF	2.38	2.38	0	2.38	2.38	1
Yearly Average of Detectable gross alpha			3.22				
Standard Deviation			1.19				

Radionuclide:	Gross NV Beta (pCi/L)	Statistical Analysis					
System Name:	System Number:	Median	Avg.	St. Dev.	Max	Min	Num
North Augusta SW	DW0210003F	3.56	3.56	0.00	3.56	3.56	1
Chelsea B/J SW	DW0720003F	3.92	3.89	0.13	4.00	3.74	3
Purrysburg B/J SW	DW0720004F	6.22	6.22	2.04	7.66	4.78	2
Yearly Average of Detectable non-volatile (NV) beta			4.56				
Standard Deviation			1.45				

Radionuclide:	Tritium (pCi/L)	Statistical Analysis					
System Name:	System Number:	Median	Avg.	St. Dev.	Max	Min	Num
North Augusta SW	DW0210003F	253	268.20	133.958	486	135	5
Chelsea B/J SW	DW0720003F	389	390.20	112.872	558	233	10
City of Savannah	DWSAVF	397	418.22	164.196	706	237	9
Purrysburg B/J SW	DW0720004F	395.5	417.08	152.196	679	216	12
Yearly Average of Detectable Tritium			373.43				
Standard Deviation			71.34				

Summary Statistics

Drinking Water Quality Monitoring

Groundwater

Radionuclide:	Gross Alpha (pCi/L)	Statistical Analysis					
System Name:	System Number:	Median	Avg.	St. Dev.	Max	Min	Num
Aiken	DW0210001	2.25	2.25	0	2.84	2.84	1
Jackson	DW0210002	4.22	4.22	0.141	4.32	4.12	2
Langley	DW0220001	2.42	2.42	0.353	2.67	2.17	2
College Acres	DW0220002	2.84	2.84	0	2.84	2.84	1
Yearly Average of Detectable gross alpha			2.93				
Standard Deviation			0.89				

Radionuclide:	Tritium (pCi/L)	Statistical Analysis					
System Name:	System Number:	Median	Avg.	St. Dev.	Max	Min	Num
New Ellenton	DW0210007	224	224.00	0	224	224	1
College Acres	DW0220002	177	177.00	0	177	177	1
Talatha Water	DW0220005	302	302.00	0	302	302	1
Barnwell	DW0610001	248	248.00	0	248	248	1
Hilda	DW0610004	220	220.00	0	220	220	1
Elko	DW0610005	191	191.00	0	191	191	1
Yearly Average of Detectable Tritium			227.00				
Standard Deviation			44.54				

Back to List of Statistical Summaries

2.3 Radiological Monitoring of Surface Water

2.3.1 Summary

The U.S. Atomic Energy Commission established the Savannah River Site (SRS) in 1950 to produce plutonium, tritium, and other materials for national defense and civilian purposes (Till et al. 2001). Due to the large number of materials that could potentially be released from SRS, the Centers for Disease Control and Prevention (CDC) performed a site assessment to determine the potential health effects of any released radionuclides to the offsite public. In 1992, the CDC hired Radiological Assessments Corporation (known as Risk Assessment Corporation as of 1998) to perform screening procedures to determine the key radionuclides released to the environment. These screening methods indicated that the main radionuclides released to surface water were tritium and cesium-137 (Cs-137). Other radionuclides of interest are strontium-90 (Sr-90), iodine-131 (I-131), cobalt-60 (Co-60) and uranium (U). The five production reactors (R, K, P, L, and C) were the primary sources for these radionuclide releases directly to site streams. Additionally, effluent from the separation areas (F- and H-Area) was discharged into storage tanks and seepage basins, but not directly into streams. However, some releases from these areas occurred due to leaks in cooling coils, which contained water that was pumped from deep wells into site streams. The fuel fabrication area (M-Area), heavy water reprocessing facility (D-Area), and the administration area (A-Area) also contributed radionuclides to liquid effluent. Onsite streams affected by these releases are Upper Three Runs, Beaver Dam Creek, Four Mile Creek, Pen Branch, Steel Creek, and Lower Three Run. All of these SRS streams are tributaries to the Savannah River (Till et al. 2001).

These SRS surface water bodies, as well as the Savannah River, continue to be the focus for monitoring and surveillance activities of the Radiological Monitoring of Surface Water (RSW) project that is part of the Environmental Surveillance and Oversight Program (ESOP). Since the Savannah River is the primary drinking water source for downstream communities, it is important to ensure radionuclide concentrations in the river are well below limits considered safe for human consumption. Surface water samples are collected and analyzed for radionuclides and the results are compared to Department of Energy-Savannah River (DOE-SR) data. The DOE-SR has conducted surveillance and monitoring activities for the purpose of determining concentrations and migration of radionuclides in the aquatic environment; detecting and verifying accidental releases, characterizing concentration trends, and determining associated impacts on human health and the environment. ESOP incorporates DOE-SR's objectives to ensure the primary goal of drinking water safety is established and met.

Section 2.3.3, Table 1 identifies sample ID, locations, rationale, and frequency. Some locations were chosen because they are considered to be public access locations. The public access locations are downstream of SRS and provide a potential means for exposure to radionuclides. Project databases were expanded and data trends for radionuclides in streams were given. These activities will allow the RSW project to generate independent data that can be shared with the public.

The RSW Project continues to collect surface water samples from 14 specific locations within and outside of the SRS boundary as part of an ambient sampling network (Section 2.3.2, Map 5.). At some locations, samples are collected three days per week as part of an enhanced sampling protocol. Depending on location and frequency, samples are analyzed for tritium, gross alpha, gross beta and gamma-emitting radionuclides.

The enhanced surface water monitoring program is intended to provide downstream drinking water customers with advance notice of the potential for increased tritium levels in the Savannah River as the result of an SRS release. This early detection facet is possible because of the continuous monitoring of six SRS streams that flow to the Savannah River. Samples are analyzed for tritium on the day of collection and results from the tritium analysis are used to project tritium activity in the Savannah River.

An additional component of the RSW Project is the Enhanced Surface Water Supplemental Monitoring Program that was implemented in 2005. Sample locations are established along streams that are in close proximity to the Saltstone High Level Waste Processing facility. The purpose of this sampling program is to identify any potential releases of gross alpha/beta emitting radionuclides primarily along Upper Three Runs and Four Mile Creek. Samples are collected on Monday and analyzed the same day as part of a quick scan early notification procedure.

ESOP began random sampling in 2004 to include more random coverage of perimeter samples (those within 50 miles of SRS) and background samples (those greater than 50 miles). This sampling program was implemented to allow future probabilistic comparisons of SRS perimeter and South Carolina (SC) background contaminant levels. These locations were randomly selected from a quadrant system established by the U.S. Department of Interior on a 7.5' topographical map of SC revision 10/92. Quadrants were established based on longitude and latitude limits (USDOI 1992). These quadrant locations are shown in Map 1. ESOP collected surface water samples in 2007 from 21 perimeter sites and 21 background sites

During the last quarter of 2007, ESOP began collecting samples from a location at SC Highway 125 and Lower Three Runs Creek. This sampling was conducted in response to elevated tritium levels detected in groundwater samples near the Chem-Nuclear facility in Snelling, SC. The purpose of adding this location was to determine any potential tritium contributions to Lower Three Runs from Chem-Nuclear. This sampling location was moved to a location (Lower Three Runs and Patterson Mill Road, SV-328) closer to the source during the first quarter of 2008.

The RSW Project will continue to collect and analyze surface water on and adjacent to the SRS. This monitoring effort will provide an improved understanding of radionuclide levels in SRS surface waters and valuable information relative to human health exposure pathways.

RESULTS AND DISCUSSION

ESOP Surface Water Data

Tritium

The primary tritium releases originated from processes associated with the reactors (R, P, K, L, and C), separation facilities (F-Area and H-Area), the heavy water facility (D-Area), and tritium recovery in the tritium facilities. The two main types of tritium releases come from direct releases from site facilities and migration from seepage basins in F-Area and H-Area, the burial ground, and the K-Area containment basin. In the early operational years, almost 100% of the releases to streams was related to direct releases. After the cessation of operational activities, most releases were a result of migration from the seepage basins. Since the mid 1970s, migration

and outcropping to streams have accounted for most of the SRS tritium released to surface water (Till et al. 2001). After 1988, the Effluent Treatment Facility (ETF) went into operation and the F-Area and H-Area basins were not used (CDC 2006). The primary purpose of the ETF was to process low level radioactive wastewater from the separation areas (SRS 2008). Periodically, ETF has controlled tritium releases to Upper Three Runs.

In 2007, tritium activity was detected at all locations where weekly samples were collected (Section 2.3.4, Ambient Monitoring Data). Average tritium activity in upstream background locations (SV-2010, Jackson Boat Landing) and SV-2027, Upper Three Runs) was lower than average tritium activity at the enhanced and ambient sample locations. Four Mile Creek and Pen Branch continue to yield the highest levels of tritium activity. Tritium activity ranged from 190 pCi/L at SV-2019 (Little Hell Landing) and SV-2010 to 279,986 pCi/L at SV-2045 (Four Mile Creek at Road C-4). Section 2.3.3, Figure 1 shows how the 2007 tritium average compares to previous years.

Tritium activity in the Savannah River at the confluences of the five SRS streams was scheduled for monitoring on a quarterly basis (Section 2.3.4, Boat Run Data). Three samples were collected at SV-2015 (Four Mile Creek mouth): one from the creek mouth, one from 30 feet downstream of the creek mouth, and one from 150 feet downstream of the creek mouth. Samples were taken at these three intervals to show the effect of the mixing zone created by the Savannah River flow. Samples from Four Mile creek mouth had the highest average tritium activity (53,788 (±4,790) pCi/L) of all creek mouth locations.

Tritium was detected in three random samples in 2007 (Section 2.3.4, Random Sample Data). Background samples collected in Charleston County (RWB4) and Berkley County (RWB10) yielded activities of 204 (±94) pCi/L and 279 (± 89) pCi/L, respectively. One perimeter sample collected in Barnwell County (RWE2) yielded an activity of 265 (±91) pCi/L.

Cesium-137

Most of the radiocesium at SRS was formed as a byproduct of the nuclear fuel and target during operation of the five production reactors. Cs-137 is an important radionuclide to monitor due to its 30 year half-life (Till et al. 2001). Cs-137 was not detected in any ESOP sample collected in 2007 (Section 2.3.4, Ambient Monitoring Data). In past years, Cs-137 has been detected in samples collected from Four Mile Creek (2003, 2005, 2006) and Lower Three Runs Creek (2002).

Gross Alpha-emitting Radionuclides

Gross alpha-emitting radionuclides were released to liquid effluent from the reactor materials area (M-Area), separations areas (F- Area and H-Area), and the reactor areas. The primary stream affected by the M-area releases was Tims Branch, which ultimately flows into Upper Three Runs. Four Mile Creek is the stream most affected by releases coming from the separation areas. Releases from the reactor areas affected all streams with the exception of Upper Three Runs (Till et al. 2001). Gross alpha-emitting radionuclides were detected at six of the eleven locations where monthly composite samples were collected, with no detects at SV-2010, SV-2040 (Beaver Dam Creek), SV-2039 (Four Mile Creek), and SV-175 (Lower Three Runs Creek at SC Highway 125) and SV-328 (Lower Three Runs Creek at Patterson Mill Road)

(Section 2.3.5). Average activity ranged from 2.64 (no Standard Deviation (SD), one detection only) pCi/L at SV-2053 (Lower Three Runs Creek and Road B) to 10.08 (±6.65) pCi/L at SV-327 (Steel Creek and SC Highway 125).

Average annual gross alpha trends for 2002-2007 are shown in Section 2.3.3, Figure 8. All averages were below the United States Environmental Protection Agency (USEPA) Maximum Contaminant Level (MCL) of 15 pCi/L for drinking water (USEPA 2002b). Gross alpha-emitting radionuclides were detected in four random samples in 2007. Perimeter samples collected in Aiken County (RWE20, RWE4) and Hampton County (RWE1) had detections of 2.44 (±1.45) pCi/L, 3.14 (±1.60) pCi/L, and 6.80 (±2.82) pCi/L, respectively. One background sample collected from Jasper County (RWB2) had a detection of 4.05 (±2.40) pCi/L.

Gross Beta-emitting Radionuclides

Gross beta-emitting radionuclides were released to liquid effluent from separations areas (F-Area and H-Area). The stream primarily affected by these releases is Four Mile Creek (Till et al. 2001). Gross beta-emitting radionuclide activity was detected in nine of eleven locations where monthly composite samples were collected, with no detections at SV-175 and SV-328 (Section 2.3.5). Average activity ranged from 3.51 (no SD, one detection only) pCi/L at SV-2053 to 5.99 (±2.03) pCi/L at SV-2039.

Average annual gross beta trends for 2002-2007 are shown in Section 2.3.3, Figure 9. All averages were below the USEPA MCL of 8 pCi/L for drinking water (USEPA 2002).

Gross beta-emitting radionuclides were detected in two random background samples in 2007. These two locations were in Jasper County (RWB2) and Charleston County (RWB4) and had detections of 6.17 (±2.15) pCi/L and 244 (±111) pCi/L, respectively. The high concentration of gross beta in RWB4 may be attributed to sample collection from a salt water source, although this cannot be verified.

ESOP and DOE-SR Data Comparison

Data from 2007 reported in this project was compared to DOE-SR reported results (Section 2.3.3, Tables 2, 3, 4). The ESOP and DOE-SR colocated sampling sites were Upper Three Runs Creek and SC Highway 125; Four Mile Creek and United States Forestry Service (USFS) Road 12.2; Pen Branch Creek and USFS Road 13.2; Steel Creek and SC Highway 125; Lower Three Runs Creek and SRS Road B; and Highway 301 Bridge at the Savannah River.

Tritium

ESOP detected tritium at all colocated sample locations. DOE-SR average tritium activities for all colocated sites were within one SD of ESOP average tritium activities (Section 2.3.3, Table 2) (WSRC 2008a). Both DOE-SR and ESOP samples indicate that Four Mile Creek (58,600 (±213) pCi/L, 59,594 (±4,971) pCi/L, respectively) and Pen Branch Creek (49,800 (±198) pCi/L, 46,360 (±15,700) pCi/L), respectively) have the highest tritium activity of all SRS streams. The 2007 ESOP and DOE-SR tritium results appear to be consistent with historically reported data values (Section 2.3.3, Figures 2-7) (SCDHEC ESOP Data Reports 2000-2006, WSRC SRS Environmental Reports 2000-2008).

Cesium-137

ESOP did not detect Cs-137 at any sampling location, so no comparison can be made. DOE-SR did detect Cs-137 at all colocated locations. DOE-SR does report values that are below detection, which may result in detections of Cs-137 at these locations.

Gross Alpha

ESOP detected gross alpha activity at all of the colocated sample locations with the exception of Four Mile Creek at USFS Road 12.2 (Section 2.3.3, Table 3). DOE-SR average gross alpha activities were within two SD of ESOP average gross alpha activities at Upper Three Runs Creek, Pen Branch Creek, and Steel Creek. DOE-SR reported a monthly average at Highway 301 and Lower Three Runs Creek. ESOP had only one detection at these two locations. Upper Three Runs Creek at SC Highway 125 exhibits the highest gross alpha concentration for DOE-SR (9.69 (±0.30) pCi/L, WSRC 2008a). ESOP samples collected from Steel Creek had the highest average concentration for gross alpha (10.08 (±6.65) pCi/L). ESOP had the highest number of detections at Upper Three Runs Creek and SC Highway 125 (SV-325, eleven detections out of twelve samples collected) with an average of 4.89 (± 2.80) pCi/L.

The 2007 ESOP gross alpha average at Steel Creek is high compared to previous years (Section 2.3.3, Figure 8). ESOP had three detections out of twelve samples from this location (5.45 (±2.18) pCi/L, 7.08 (±3.15) pCi/L, 17.7 (± 3.10) pCi/L). The DOE-SR average from this location (2.09 (±0.16) pCi/L) is within two SD's of the ESOP average (10.08 (±6.65) pCi/L). The ESOP 2002-2006 average at this location is between 2.00-3.00 pCi/L (SCDHEC ESOP Data Reports 2003-2007). The highest number of detections (five) in any year for this period occurred in 2003 with the maximum concentration being 3.49 (±1.49) pCi/L (SCDHEC 2004b). Based on this data, it is possible that past SRS activities contributed alpha-emitting radionuclides to Steel Creek during 2007.

Gross Beta

ESOP detected gross beta activity at all of the colocated sampling locations (Section 2.3.3, Table 4) with the exception of Lower Three Runs Creek at Patterson Mill Rd. DOE-SR average gross beta activities were within one SD of ESOP average gross beta activities at Four Mile Creek. DOE-SR reported a monthly average at Upper Three Runs Creek, Pen Branch Creek, Steel Creek, Highway 301 Bridge, and Lower Three Runs Creek at SRS Road B. ESOP had only one detection at these locations. DOE-SR and ESOP samples collected from Four Mile Creek exhibited the highest gross beta activities (7.11 (±0.19) pCi/L, 5.99 (±2.03) pCi/L, respectively).

CONCLUSIONS AND RECOMMENDATIONS

All tritium results for the public access locations downstream from SRS were below the EPA MCL annual average of 20,000 pCi/L for drinking water. However, data generated from samples collected at the mouth of Four Mile Creek indicate that the public could come into contact with tritium activity greater than the MCL at that location.

Differences in analytical results for tritium activity at sampling sites colocated with DOE-SR showed DOE-SR results were within one SD of ESOP results. Also, a comparison of gross alpha

data identified DOE-SR results within two SDs of ESOP results. DOE-SR gross beta average for Four Mile Creek was within one SD of the ESOP average. ESOP typically detects gross alpha emitting radionuclides from samples collected from the Upper Three Runs Creek location (SV-325). Furthermore, DOE-SR samples yield alpha detections from this same location. ESOP only had one detection for gross beta at each sampling location with the exception of Four Mile Creek, which had 11 detections out of 12 samples. DOE-SR had 12 detections out of 12 samples. These gross alpha and beta detections are most likely attributed to past activities from facilities upstream of these respective sampling locations.

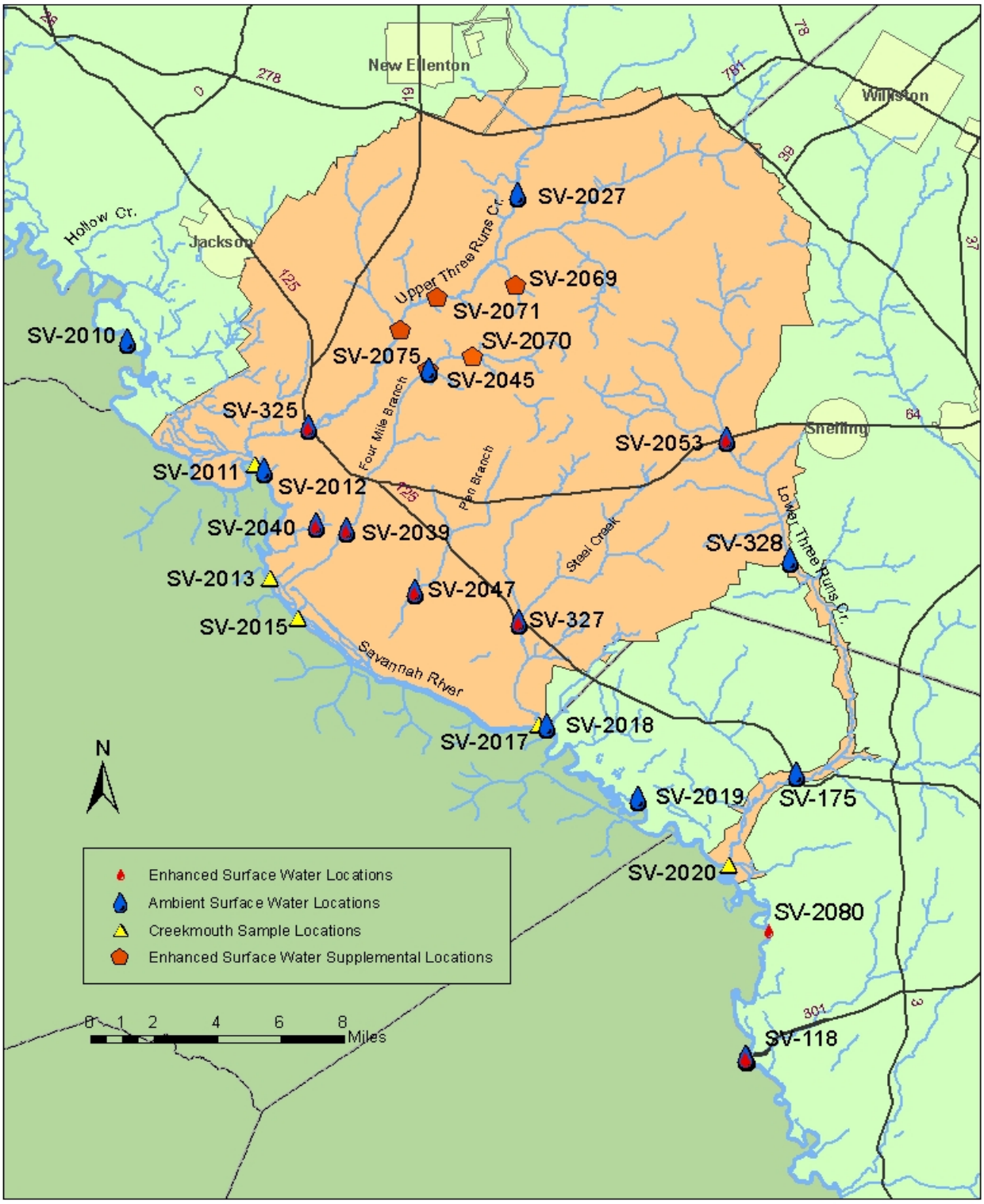
ESOP utilizes Minimum Detectable Activities (MDAs) in reporting radioactivity and does not report anything below MDA. DOE-SR, however, incorporates all values, including those below the MDA and negative numbers. This approach accounts for seemingly large differences between average values. Also, differences could be attributed, in part, to the nature of the water medium and the specific point and time when the sample was collected.

ESOP will continue independent monitoring of surface water and will periodically evaluate modifications of the monitoring activities to better accomplish the project's goals and objectives. Monitoring will continue as long as there are activities at the SRS that create the potential for contamination entering the environment. Continued monitoring will provide an improved understanding of radionuclide activity in SRS surface waters and the Savannah River, which will provide valuable information to human health exposure pathways. This comparison of data results allows for independent data evaluation of DOE-SR monitoring activities.

Back to Table of Contents

2.3.2

Map 5. Radiological Monitoring of Surface Water Sampling Locations for 2007 Back to Maps



2.3.3 Tables and Figures
Radiological Monitoring of Surface Water

Table 1. 2007 Radiological Monitoring of Surface Water Sampling Locations and Frequency

Ambient Monitoring Locations

ID	Location	Rationale	Frequency
SV-2010	Savannah River @ RM 170.5 (Jackson Boat Landing)	Accessible to public; Above all SRS operations; Near Jackson population center; Upriver control; River monitoring	Weekly H3 / Monthly AB Composite
SV-2027	Upper Three Runs @ SRS Road 2-1	Within SRS perimeter; Upstream from SRS operations; Upstream control; Tributary monitoring	Weekly H3
SV-2012	Savannah River @ RM 170.5 (TNX Boat Landing)	Adjacent to SRS perimeter; River monitoring	Weekly H3
SV-325	Upper Three Runs @ SC 125 (SRS Road A)	Within SRS perimeter; Below SRS operations areas; Tributary monitoring	Weekly H3 / Monthly AB Composite
SV-2045	Four Mile Creek @ Road C-4	Within SRS perimeter; Below SRS operations areas and HLW tanks; Tributary monitoring	Weekly H3
SV-2040	Beaver Dam Creek @ D-Area	Within SRS perimeter; Below SRS operations areas; Tributary monitoring	Weekly H3 / Monthly AB Composite
SV-2039	Four Mile Creek @ Road A-12.2	Within SRS perimeter; Below SRS operations areas; Tributary monitoring	Weekly H3 / Monthly AB Composite
SV-2047	Pen Branch @ Road A-13.2	Within SRS perimeter; Below SRS operations areas; Tributary monitoring	Weekly H3 / Monthly AB Composite
SV-327	Steel Creek @ SC 125 (SRS Road A)	Within SRS perimeter; Below SRS operations areas; Tributary monitoring	Weekly H3 / Monthly AB Composite
SV-2018	Savannah River @ RM 141 (Steel Creek Boat Landing)	Accessible to public; Adjacent to SRS perimeter; Below SRS operations and tributaries; River monitoring	Weekly H3 / Monthly AB Composite
SV-2019	Savannah River @ RM 134.5 (Little Hell Boat Landing)	Accessible to public; Below SRS operations and tributaries; River monitoring	Weekly H3
SV-175	Lower Three Runs @ SC 125	Within SRS perimeter; Below SRS operations areas and PAR pond; Tributary monitoring	Weekly H3 / Monthly AB Composite
SV-118	Savannah River @ RM 118.8 (Highway 301 Bridge)	Accessible to public; Below SRS operations and tributaries; River monitoring	Weekly H3 / Monthly AB Composite
SV-328	Lower Three Runs @ Patterson Mill Rd.	Within SRS perimeter; Below SRS operations areas and PAR pond; Tributary monitoring	Weekly H3 / Monthly AB Composite
SV-2053	Lower Three Runs @ Road B	Within SRS perimeter; Below SRS operations areas and PAR pond; Tributary monitoring	Weekly H3 / Monthly AB Composite

Notes:
1. ID is Sampling Location Identification Code Number
2. RM is River Mile
3. H3 is Tritium
4. AB is Alpha/Beta

Tables and Figures
Radiological Monitoring of Surface Water

Table 1. (Cont.)

Creek Mouth Locations

ID	Location	Rationale	Frequency
SV-2011	Upper Three Runs Mouth @ RM 157.4	Accessible to public; Adjacent to SRS; Below SRS operations areas; Tributary monitoring	Quarterly H3
SV-2013	Beaver Dam Creek Mouth @ RM 152.3	Accessible to public; Adjacent to SRS; Below SRS operations areas; Tributary monitoring	Quarterly H3
SV-2015	Four Mile Creek @ RM 150.6	Accessible to public; Adjacent to SRS; Below SRS operations areas; Tributary monitoring	Quarterly H3
SV-2017	Steel Creek Mouth @ RM 141.5	Accessible to public; Adjacent to SRS; Downstream from SRS operations; Tributary monitoring	Quarterly H3
SV-2020	Lower Three Runs Mouth @ RM 129.1	Accessible to public; Adjacent to SRS; Downstream from SRS operations; Tributary monitoring	Quarterly H3

Supplemental Locations

ID	Location	Rationale	Frequency
SV-2069	McQueen Branch off Monroe Owens Rd.	Downstream from SRS operations; Z-Area	Weekly AB
SV-2070	Four Mile Creek @ Rd. 4	Within SRS perimeter; Below SRS operations areas and HLW tanks; Tributary monitoring	Weekly AB
SV-2071	Upper Three Runs @ Road C-4	Downstream from F- & H-Area HLW Tanks	Weekly AB
SV-2045	Four Mile Creek @ Road C-4	Within SRS perimeter; Below SRS operations areas and HLW tanks; Tributary monitoring	Weekly AB
SV-2075	Upper Three Runs @ Road C	Downstream from F- & H-Area HLW Tanks	Weekly AB

Notes:
1. ID is Sampling Location Identification Code Number
2. RM is River Mile
3. H3 is Tritium
4. AB is Alpha/Beta

Tables and Figures
Radiological Monitoring of Surface Water

Table 2. 2007 Tritium Data Comparison for ESOP and DOE-SR Colocated Sampling Locations

Sample Location	Average Concentration (pCi/L)	Standard Deviation (pCi/L)	Maximum Concentration (pCi/L)	Minimum Concentration (pCi/L)	Number of Samples	Number of Detects
Upper Three Runs (SV-325)	1,930	1,365	7,258	391	52	52
U3R-4 at Road A	1,680	59	3,160	489	12	12
Four Mile Creek (SV-2039)	59,594	4,971	71,012	51,167	52	52
FM-6 at Road A-12.2	58,600	213	67,300	53,000	12	12
Pen Branch (SV-2047)	46,360	15,700	68,968	12,458	52	52
PB-3 at Road 13.2	49,800	198	61,600	34,600	12	12
Steel Creek (SV-327)	4,147	1,441	8,442	2,251	52	52
SC-4 Steel Creek at Road A	3,980	70	7,620	2,260	12	12
Highway 301 Bridge (SV-118)	413	135	758	202	52	47
River Mile 118.8	403	8	1,060	140	52	52
Lower Three Runs at Patterson Mill Rd. (SV-328)	2,834	567	3,495	2,059	8	8
L3R-2 at Patterson Mill Rd	3,020	67	4,110	1,950	12	12
Lower Three Runs (SV-2053)	399	90	589	234	52	49
L3R-1A at Road B	397	50	1,280	54	12	4

Notes:
1. Shaded areas represent SCDHEC data and unshaded areas represent DOE-SR data.
2. DOE-SR data from the SRS Environmental Data Report for 2007.
3. SV-175 was only sampled for the months of September and October. Sampling location was moved to SV-328 for November and December.
4. NR is Not Reported.
5. DOE-SR sampling locations:
   U3R-4: Upper Three Runs at SC Highway 125
   FM-6: Four Mile Creek at USFS Road A-12.2
   PB-3: Pen Branch at USFS Road 13.2
   SC-4: Steel Creek at SC Highway 125
   L3R-2: Lower Three Runs at Patterson Mill Road
   L3R-1A: Lower Three Runs at SRS Road B

Tables and Figures
Radiological Monitoring of Surface Water

Table 3. 2007 Gross Alpha Data Comparison for ESOP and DOE-SR Colocated Sampling Locations

Sample Location	Average Concentration (pCi/L)	Standard Deviation (pCi/L)	Maximum Concentration (pCi/L)	Minimum Concentration (pCi/L)	Number of Samples	Number of Detects
Upper Three Runs (SV-325)	4.89	2.80	10.80	2.56	12	11
U3R-4 at Road A	9.69	0.30	21.60	1.34	12	12
Four Mile Creek (SV-2039)	ND	NA	NA	NA	12	0
FM-6 at Road A-12.2	0.45	0.07	0.88	0.13	12	3
Pen Branch (SV-2047)	3.51	1.58	5.29	2.25	12	3
PB-3 at Road 13.2	1.79	0.14	6.14	0.02	12	9
Steel Creek (SV-327)	10.08	6.65	17.70	5.45	12	3
SC-4 Steel Creek at Road A	2.09	0.16	10.70	0.23	12	8
Highway 301 Bridge (SV-118)	4.34*	1.88*	NA	NA	12	1
River Mile 118.8	0.40	0.05	1.55	-0.38	52	3
Lower Three Runs (SV-2053)	2.64*	1.34*	NA	NA	12	1
L3R-1A at Road B	2.32	0.22	7.70	0.24	12	9

Notes:

1. Shaded areas represent SCDHEC data and unshaded areas represent DOE-SR data.
2. DOE-SR data is from the SRS Environmental Data Report for 2007.
3. NA is Not Applicable.
4. ND is No Detects.
5. NR is Not Reported.
6. * denotes actual value and uncertainty (±2sd) for one detection for sampling location.
7. DOE-SR sampling locations:
   - U3R-4: Upper Three Runs at SC Highway 125
   - FM-6: Four Mile Creek at USFS Road A-12.2
   - PB-3: Pen Branch at USFS Road 13.2
   - SC-4: Steel Creek at SC Highway 125
   - L3R-2: Lower Three Runs at Patterson Mill Road
   - L3R-1A: Lower Three Runs at SRS Road B

Tables and Figures
Radiological Monitoring of Surface Water

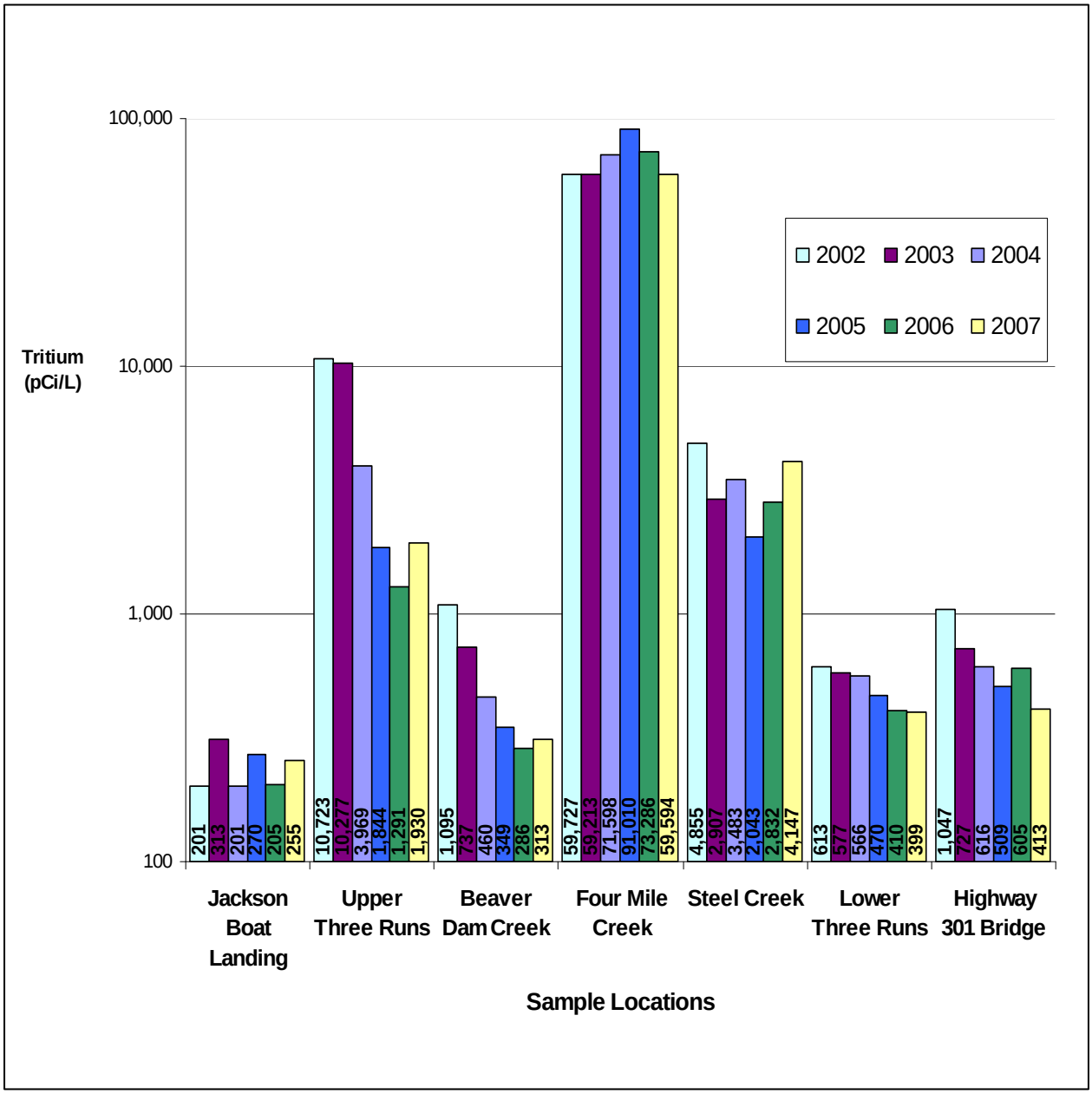
Table 4. 2007 Gross Beta Data Comparison for ESOP and DOE-SR Colocated Sampling Locations

Sample Location	Average Concentration (pCi/L)	Standard Deviation (pCi/L)	Maximum Concentration (pCi/L)	Minimum Concentration (pCi/L)	Number of Samples	Number of Detects
Upper Three Runs (SV-325)	4.20*	2.17*	NA	NA	12	1
U3R-4 at Road A	4.15	0.21	11.30	1.07	12	11
Four Mile Creek (SV-2039)	5.99	2.03	10.30	3.96	12	10
FM-6 at Road A-12.2	7.11	0.19	10.90	4.97	12	12
Pen Branch (SV-2047)	3.94*	2.14*	NA	NA	12	1
PB-3 at Road 13.2	1.85	0.14	3.86	0.27	12	9
Steel Creek (SV-327)	4.51*	1.89*	NA	NA	12	1
SC-4 Steel Creek at Road A	1.97	0.13	5.62	0.73	12	8
Highway 301 Bridge (SV-118)	4.77*	2.00*	NA	NA	12	1
River Mile 118.8	1.98	0.10	4.27	-1.16	52	32
Lower Three Runs (SV-2053)	3.51*	1.83*	NA	NA	12	1
L3R-1A at Road B	3.81	0.25	9.27	1.44	12	11

Notes:
1. Shaded areas represent SCDHEC data and unshaded areas represent DOE-SR data.
2. DOE-SR data is from the SRS Environmental Data Report for 2007.
3. NA is Not Applicable.
4. ND is No Detects.
5. NR is Not Reported.
6. * denotes actual value and uncertainty (±2sd) for one detection for sampling location.
7. DOE-SR sampling locations:
   - U3R-4: Upper Three Runs at SC Highway 125
   - FM-6: Four Mile Creek at USFS Road A-12.2
   - PB-3: Pen Branch at USFS Road 13.2
   - SC-4: Steel Creek at SC Highway 125
   - L3R-2: Lower Three Runs at Patterson Mill Road
   - L3R-1A: Lower Three Runs at SRS Road B

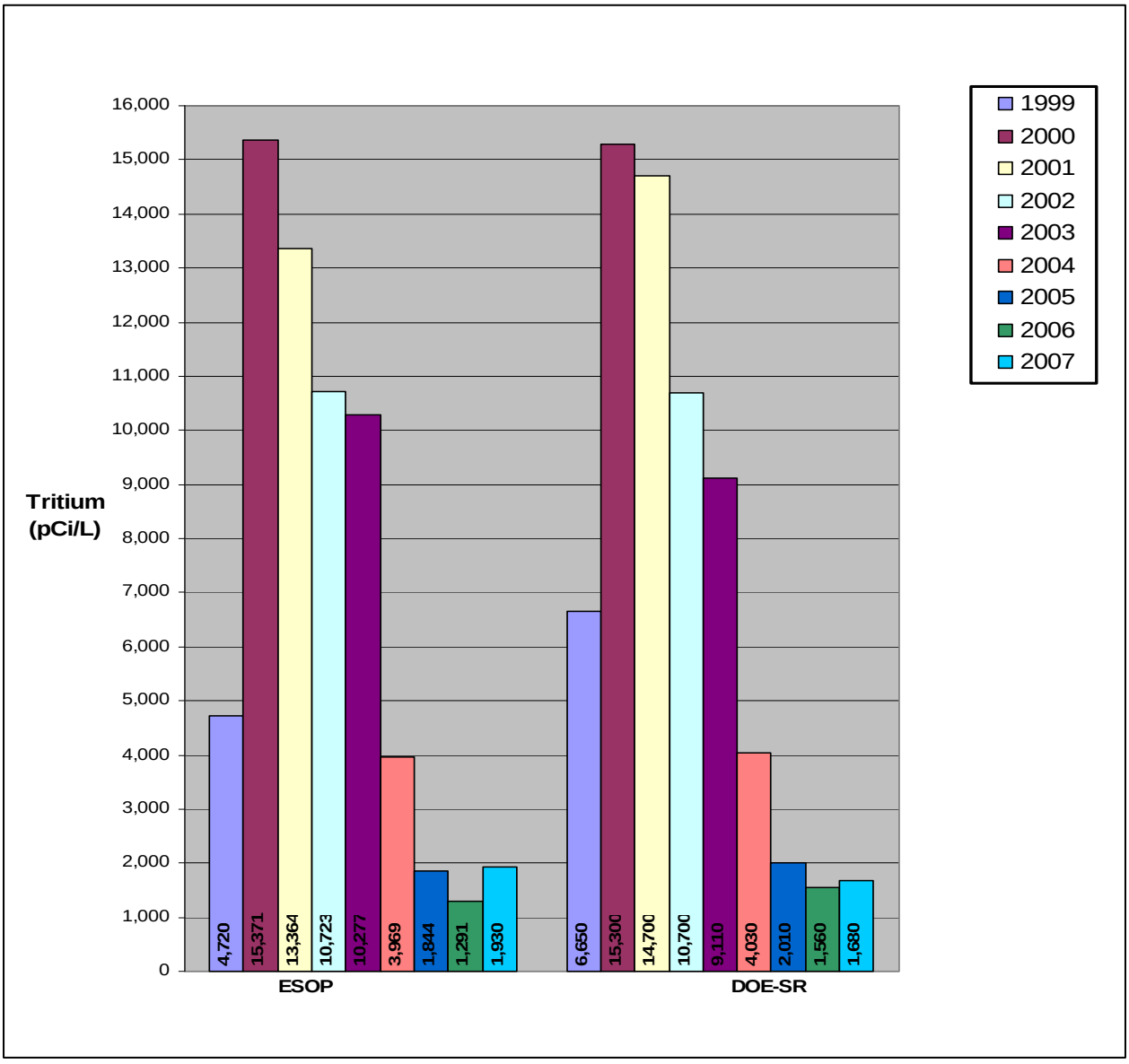
Tables and Figures
Radiological Monitoring of Surface Water

Figure 1. ESOP Average Tritium Trends, 2002-2007 (SCDHEC 2003-2007).



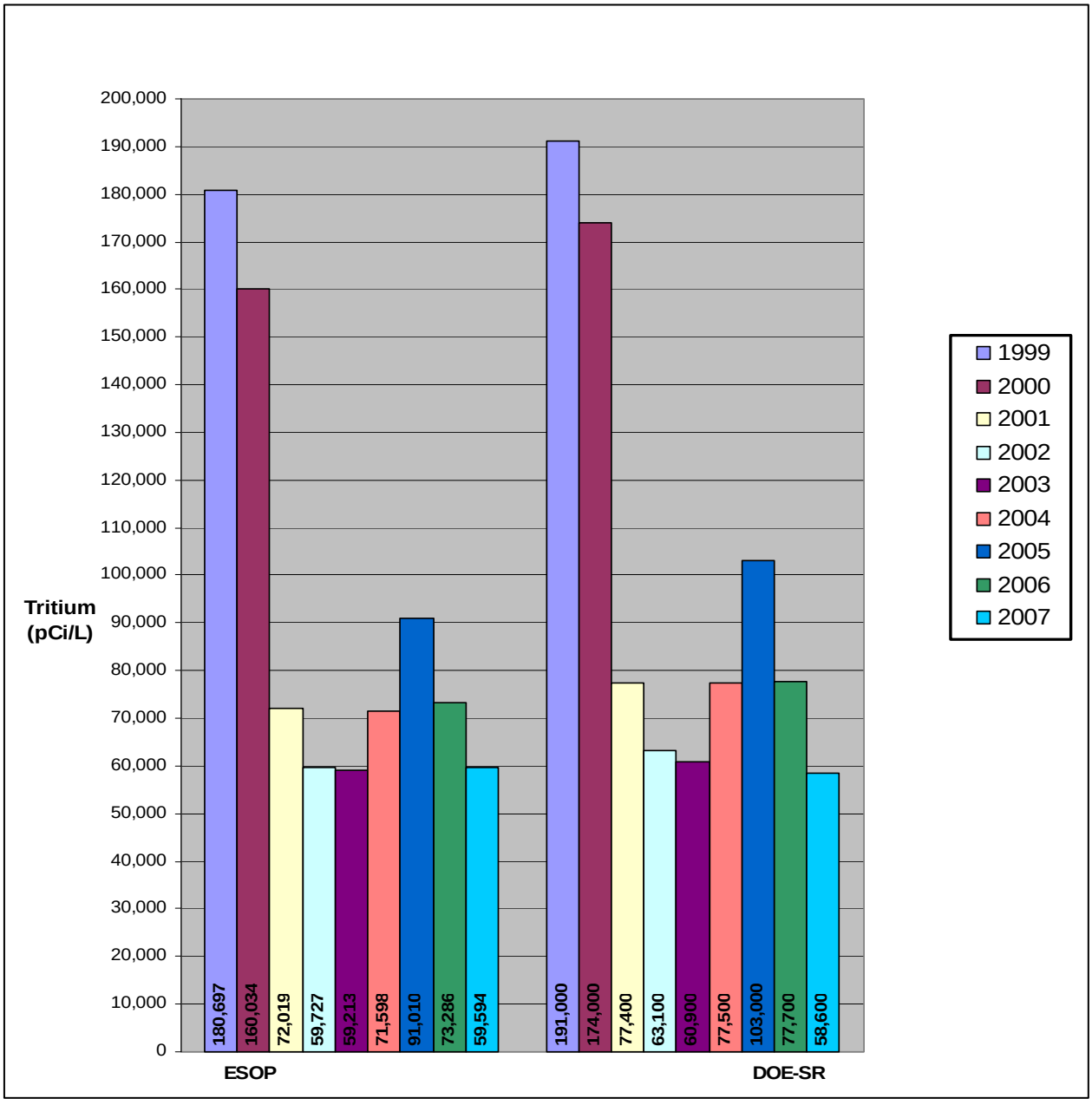
Tables and Figures
Radiological Monitoring of Surface Water

Figure 2. Average Tritium Data Trends For SCDHEC and DOE-SR at Upper Three Runs and SC Highway 125 (WSRC 2000-2008, SCDHEC 2000-2007).



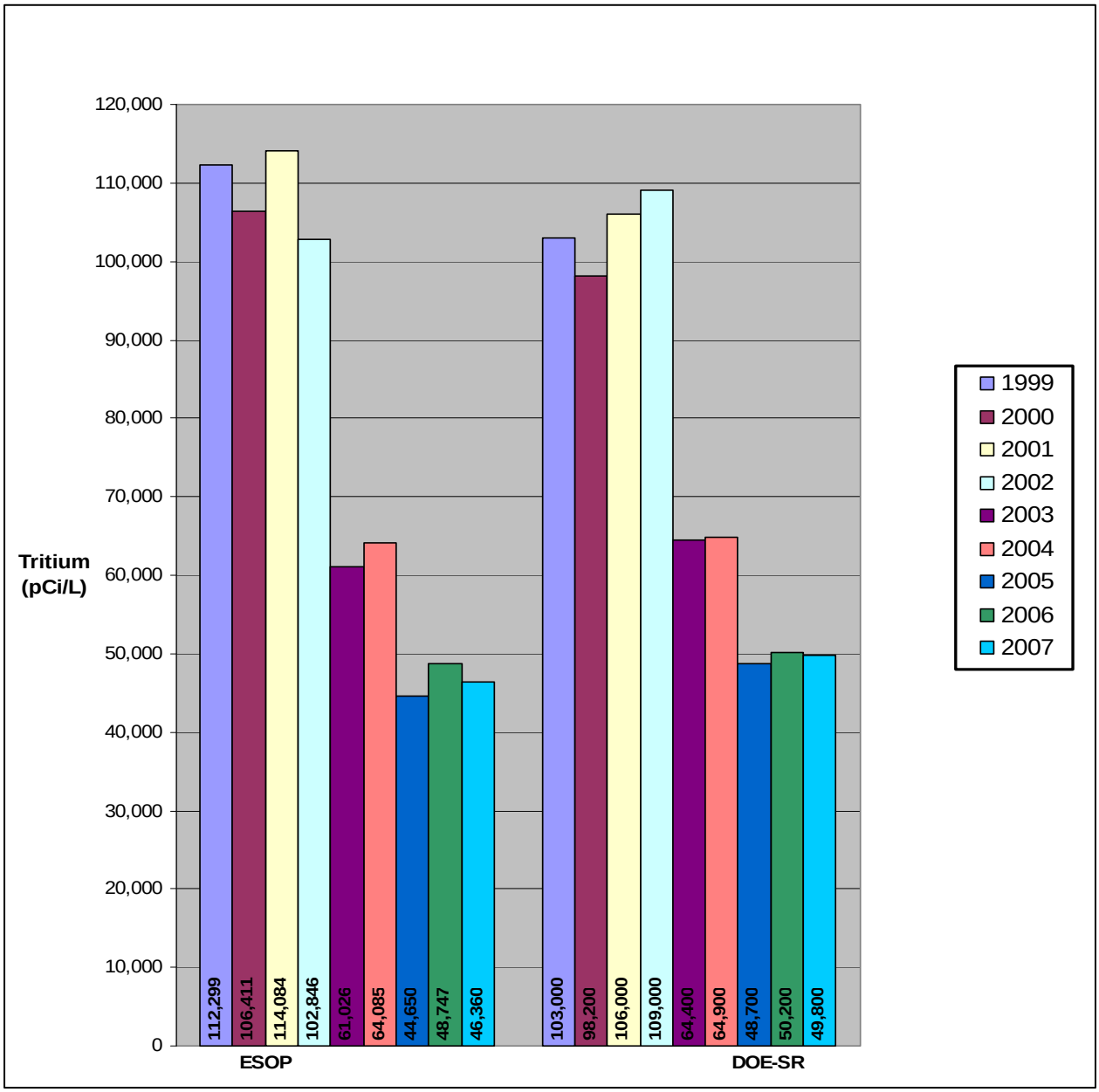
Tables and Figures
Radiological Monitoring of Surface Water

Figure 3. Average Tritium Data Trends For SCDHEC and DOE-SR at Four Mile Creek and USFS Road 12.2 (WSRC 2000-2008, SCDHEC 2000-2007).



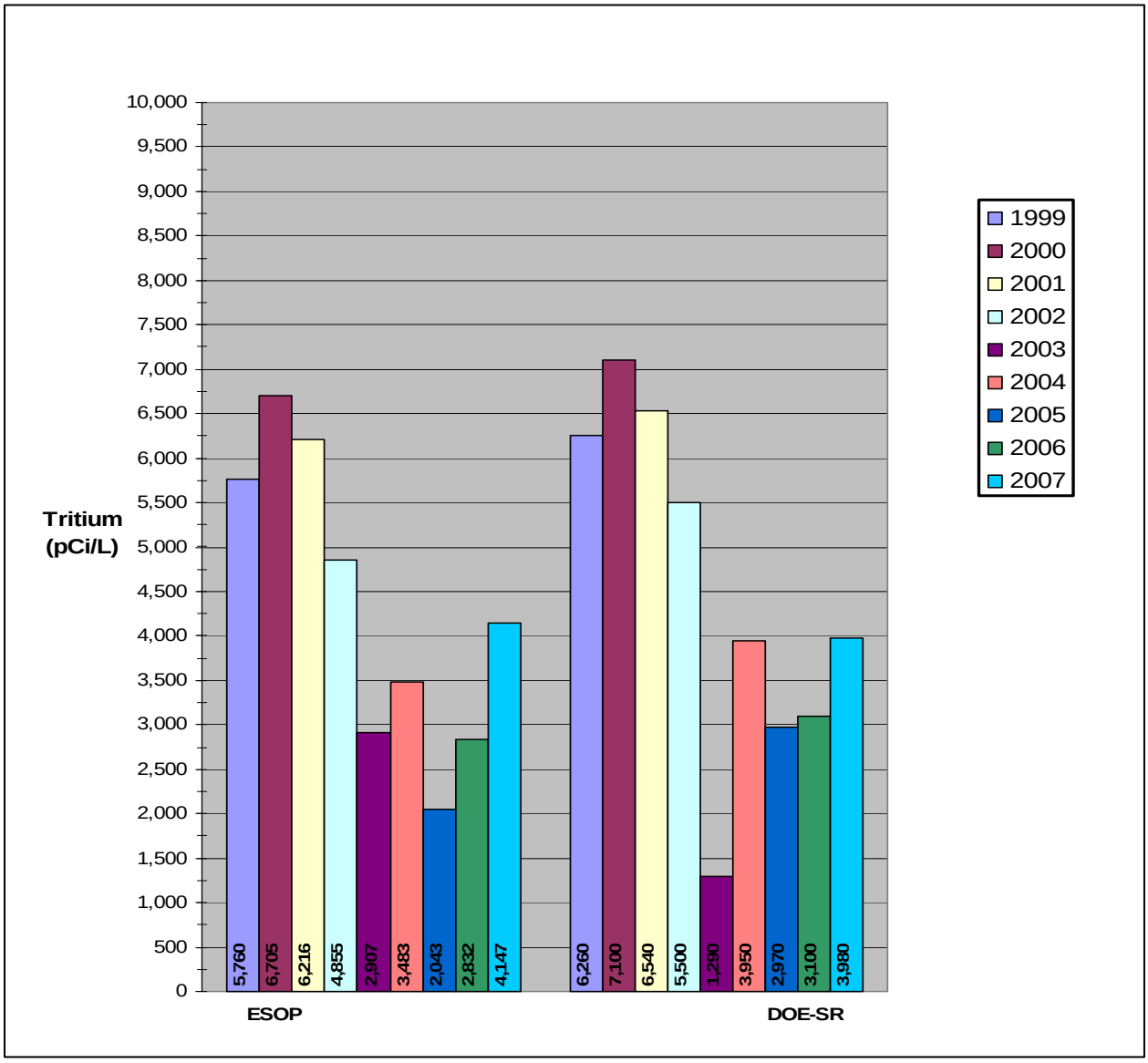
Tables and Figures
Radiological Monitoring of Surface Water

Figure 4. Average Tritium Data Trends For SCDHEC and DOE-SR at Pen Branch and USFS Road 13.2 (WSRC 2000-2008, SCDHEC 2000-2007).



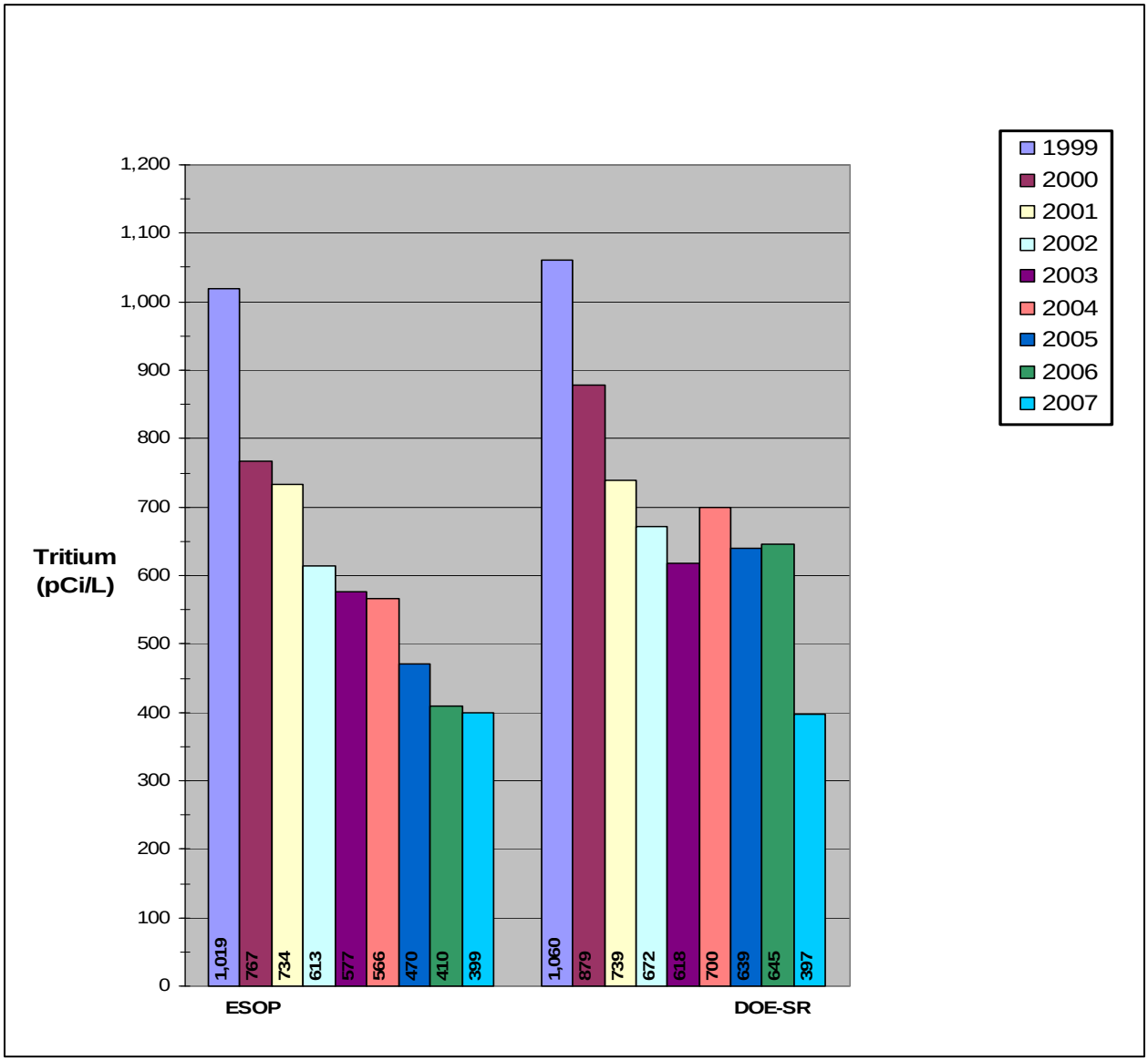
Tables and Figures
Radiological Monitoring of Surface Water

Figure 5. Average Tritium Data Trends For SCDHEC and DOE-SR at Steel Creek and SC Highway 125 (WSRC 2000-2008, SCDHEC 2000-2007).



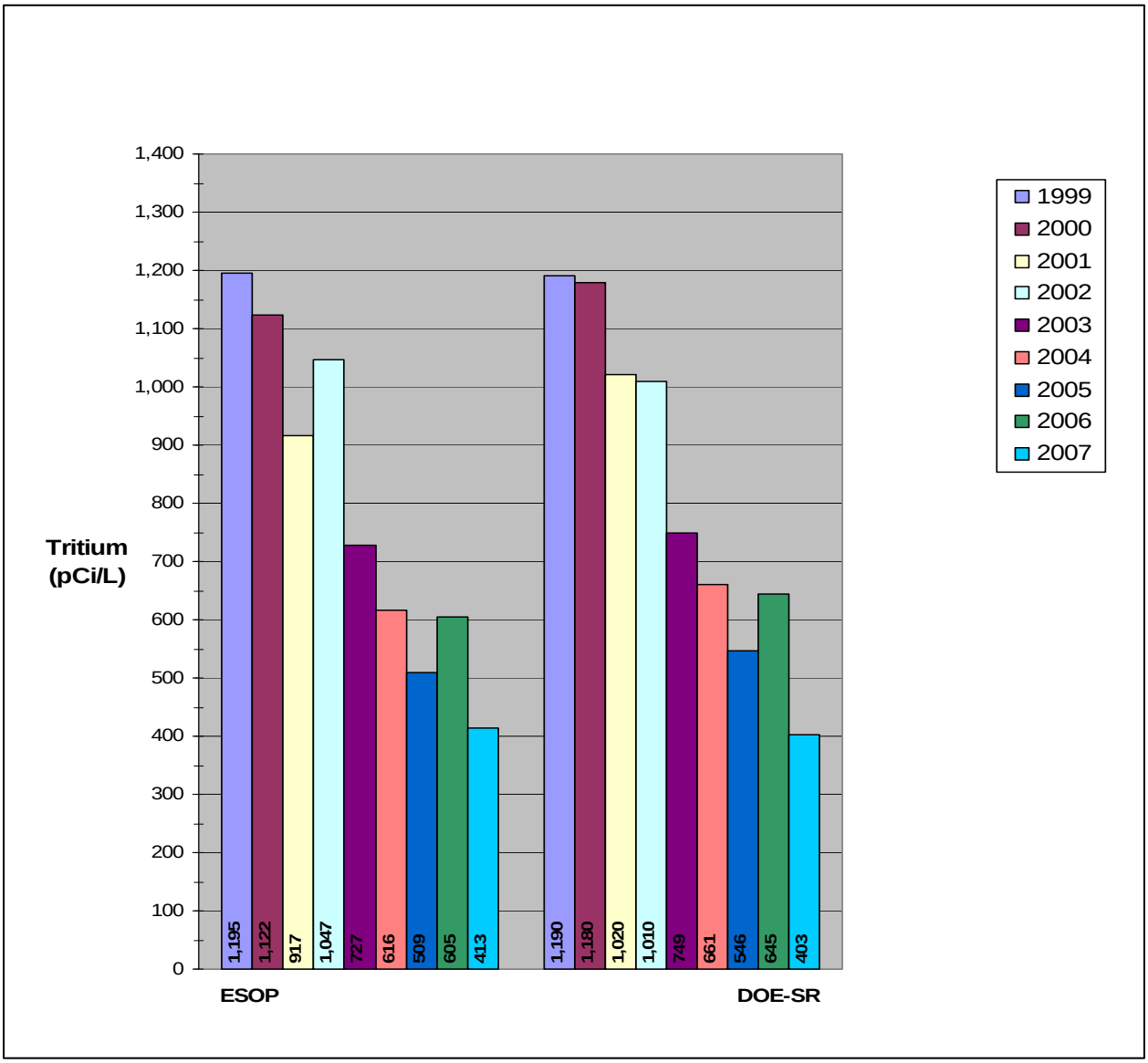
Tables and Figures
Radiological Monitoring of Surface Water

Figure 6. Average Tritium Data Trends For SCDHEC and DOE-SR at Lower Three Runs and SRS Road B (WSRC 2000-2008, SCDHEC 2000-2007).



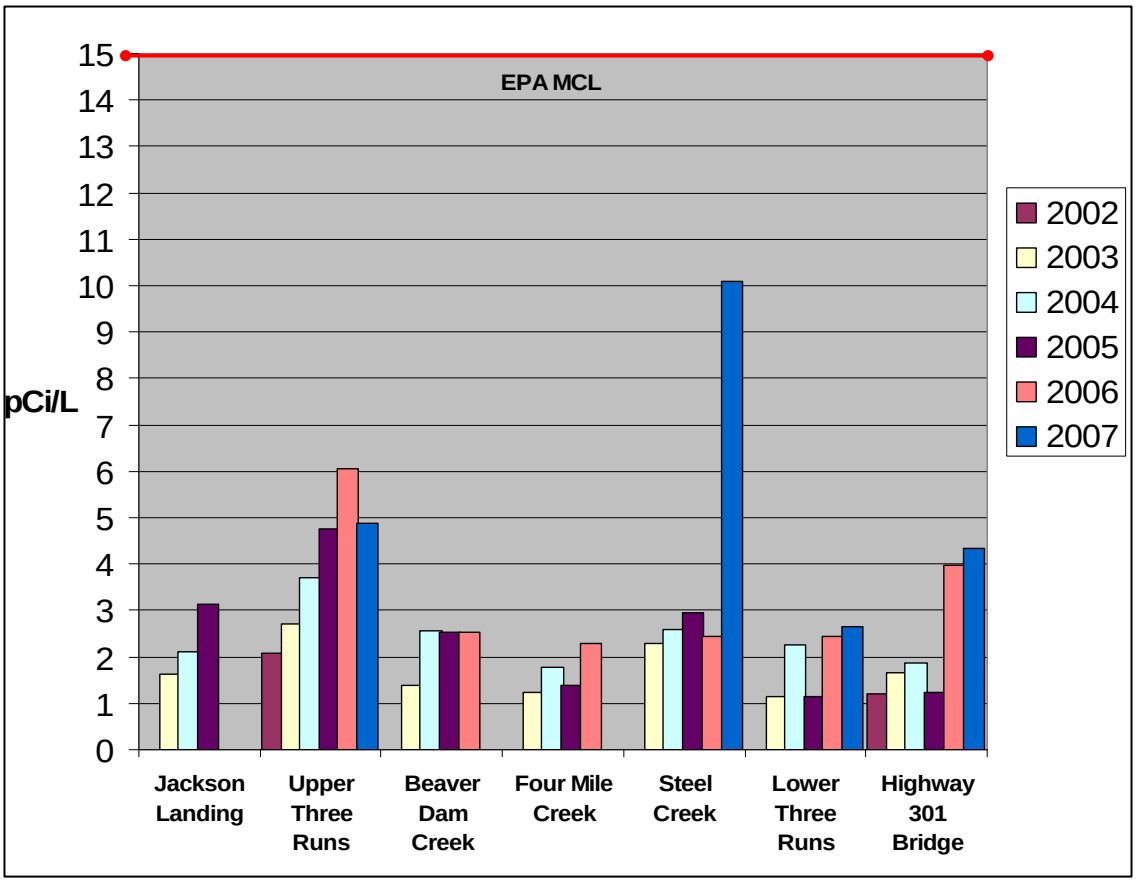
Tables and Figures
Radiological Monitoring of Surface Water

Figure 7. Average Tritium Data Trends For SCDHEC and DOE-SR at the Savannah River and US Highway 301 Bridge (WSRC 2000-2008, SCDHEC 2000-2007).



Tables and Figures
Radiological Monitoring of Surface Water

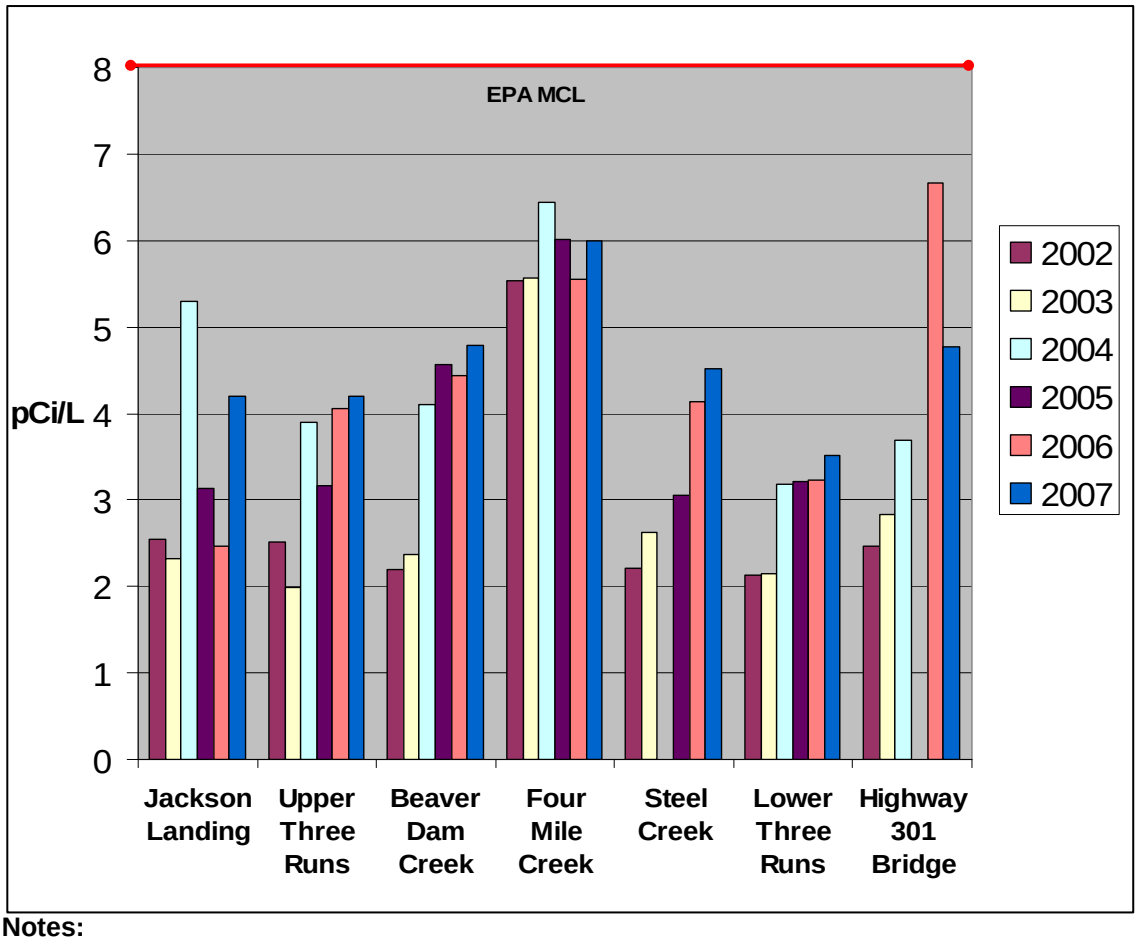
Figure 8. Average Gross Alpha Data SCDHEC 2002-2007.



Notes:
1. **No detects at Jackson Landing, Beaver Dam Creek, Four Mile Creek, Steel Creek, and Lower Three Runs in 2002**
2. **No detects at Jackson Landing in 2006 and 2007.**
3. **No detects at Jackson Boat Landing, Beaver Dam Creek, and Four Mile Creek in 2007.**

Tables and Figures
Radiological Monitoring of Surface Water

Figure 9. Average Gross Beta Data SCDHEC 2002-2007



Notes:
1. No detects at Steel Creek in 2004 and Highway 301 in 2005.

Back to Tables and Figures

2.3.4 Data Tables

Radiological Monitoring of Surface Water

Ambient Data **103**

Boat Run Data **114**

Random Sample Data **115**

Back to List of Data Tables

Radiological Monitoring of Surface Water
Ambient Data

Jackson Boat Landing (SV-2010)											
Date	Tritium		Gross Alpha			Gross Beta			Cs-137		
	pCi/L	+/-2 Sigma	pCi/L	+/-2 Sigma	LLD	pCi/L	+/-2 Sigma	LLD	pCi/L	+/-2 Sigma	MDA
01/03/07	**221**	**88**	<LLD		2.07	**4.20**	**2.15**	**3.90**	<MDA		1.52
01/10/07	<196										
01/17/07	<196										
01/24/07	<195										
01/31/07	<195		<LLD		2.04	<LLD		2.81	<MDA		3.92
02/07/07	**364**	**96**									
02/14/07	<190										
02/21/07	<193										
02/28/07	<195		<LLD		2.01	<LLD		3.9	<MDA		3.06
03/07/07	**271**	**92**									
03/14/07	<197										
03/21/07	<187										
03/28/07	<192		<LLD		2.02	<LLD		4.15	<MDA		2.99
04/04/07	<206										
04/11/07	<202										
04/18/07	<206										
04/25/07	<191		<LLD		2.93	<LLD		3.70	<MDA		1.46
05/02/07	<197										
05/09/07	<205										
05/16/07	<196										
05/23/07	<203										
05/30/07	<196		<LLD		2.94	<LLD		3.94	<MDA		1.82
06/06/07	<204										
06/13/07	<204										
06/20/07	<202										
06/27/07	<202		<LLD		2.79	<LLD		3.90	<MDA		2.26
07/04/07	<202										
07/11/07	<198										
07/18/07	<208										
07/25/07	<205		<LLD		2.31	<LLD		4.00	<MDA		4.00
08/01/07	<207										
08/08/07	<208										
08/15/07	**251**	**95**									
08/22/07	<204										
08/29/07	**209**	**93**	<LLD		2.97	<LLD		4.30	<MDA		3.99
09/05/07	**201**	**93**									
09/12/07	<203										
09/19/07	**275**	**96**									
09/26/07	<201		<LLD		3.02	<LLD		3.29	<MDA		1.68
10/03/07	<204										
10/10/07	<201										
10/17/07	**190**	**89**									
10/24/07	<189										
10/31/07	<186		<LLD		2.77	<LLD		3.93	<MDA		1.91
11/07/07	<192										
11/14/07	<191										
11/21/07	**213**	**89**									
11/28/07	<200		<LLD		2.67	<LLD		3.51	<MDA		2.49
12/05/07	<195										
12/12/07	<179										
12/19/07	**351**	**87**									
12/26/07	<189										

Notes:
1. Tritium samples are weekly 80 mL grab sample 100 minute scans.
2. Gross alpha, gross beta, and gamma samples are monthly composites
3. Monthly composites begin on the last Wednesday of the previous month.

Radiological Monitoring of Surface Water
Ambient Data

Upper Three Runs @ SC 125 (SV-325)											
Date	Tritium		Gross Alpha			Gross Beta			Cs-137		
	pCi/L	+/-2 Sigma	pCi/L	+/-2 Sigma	LLD	pCi/L	+/-2 Sigma	LLD	pCi/L	+/-2 Sigma	MDA
01/03/07	**849**	**113**	**3.00**	**1.37**	**1.84**	<LLD		3.88	<MDA		1.98
01/10/07	**728**	**113**									
01/17/07	**783**	**115**									
01/24/07	**735**	**111**									
01/31/07	**706**	**111**	**3.87**	**1.46**	**1.89**	<LLD		2.8	<MDA		2.97
02/07/07	**1832**	**145**									
02/14/07	**1452**	**134**									
02/21/07	**1526**	**136**									
02/28/07	**1992**	**149**	**2.66**	**1.30**	**1.77**	<LLD		3.88	<MDA		2.90
03/07/07	**3038**	**174**									
03/14/07	**1824**	**145**									
03/21/07	**2450**	**160**									
03/28/07	**3742**	**190**	**2.56**	**1.30**	**1.79**	<LLD		4.12	<MDA		3.23
04/04/07	**3806**	**194**									
04/11/07	**7258**	**254**									
04/18/07	**3731**	**192**									
04/25/07	**3967**	**195**	**6.82**	**2.04**	**2.51**	<LLD		3.64	<MDA		1.82
05/02/07	**4110**	**199**									
05/09/07	**1802**	**148**									
05/16/07	**1821**	**147**									
05/23/07	**2017**	**153**									
05/30/07	**1690**	**142**	**9.04**	**2.33**	**2.67**	**4.20**	**2.17**	**3.90**	<MDA		1.95
06/06/07	**732**	**116**									
06/13/07	**869**	**120**									
06/20/07	**391**	**101**									
06/27/07	**438**	**103**	**3.55**	**1.67**	**2.38**	<LLD		3.83	<MDA		2.35
07/04/07	**767**	**115**									
07/11/07	**845**	**116**									
07/18/07	**450**	**103**									
07/25/07	**787**	**117**	**10.8**	**2.40**	**2.16**	<LLD		3.98	<MDA		3.97
08/01/07	**1222**	**132**									
08/08/07	**3569**	**191**									
08/15/07	**3721**	**193**									
08/22/07	**3699**	**193**									
08/29/07	**2184**	**155**	**5.00**	**1.89**	**2.59**	<LLD		4.24	<MDA		4.00
09/05/07	**2249**	**158**									
09/12/07	**2369**	**161**									
09/19/07	**2231**	**157**									
09/26/07	**2598**	**159**	**3.35**	**1.72**	**2.6**	<LLD		3.23	<MDA		1.63
10/03/07	**558**	**108**									
10/10/07	**2276**	**144**									
10/17/07	**544**	**102**									
10/24/07	**1656**	**138**									
10/31/07	**2272**	**99**	<LLD		2.3	<LLD		3.85	<MDA		1.79
11/07/07	**588**	**106**									
11/14/07	**483**	**100**									
11/21/07	**757**	**110**									
11/28/07	**929**	**120**	**3.09**	**1.59**	**2.27**	<LLD		3.45	<MDA		2.44
12/05/07	**533**	**104**									
12/12/07	**2912**	**169**									
12/19/07	**2985**	**168**									
12/26/07	**2864**	**170**									

Notes:
1. Tritium samples are weekly 80 mL composite sample 100 minute scans
2. Gross alpha, gross beta, and gamma samples are monthly composites
3. Monthly composites begin on the last Wednesday of the previous month.

Radiological Monitoring of Surface Water
Ambient Data

Beaver Dam Creek (SV-2040)											
Date	Tritium		Gross Alpha			Gross Beta			Cs-137		
	pCi/L	+/-2 Sigma	pCi/L	+/-2 Sigma	LLD	pCi/L	+/-2 Sigma	LLD	pCi/L	+/-2 Sigma	MDA
01/03/07	**278**	**90**	<LLD		2.13	**5.12**	**2.19**	**3.91**	<MDA		1.88
01/10/07	**346**	**98**									
01/17/07	<196										
01/24/07	<195										
01/31/07	**207**	**90**	<LLD		2.07	<LLD		2.81	<MDA		3.17
02/07/07	**417**	**98**									
02/14/07	**418**	**98**									
02/21/07	**324**	**95**									
02/28/07	**390**	**98**	<LLD		2.07	<LLD		3.91	<MDA		2.82
03/07/07	**351**	**95**									
03/14/07	**367**	**98**									
03/21/07	**352**	**94**									
03/28/07	**323**	**97**	<LLD		2.04	<LLD		4.15	<MDA		3.19
04/04/07	**294**	**99**									
04/11/07	**455**	**103**									
04/18/07	**384**	**103**									
04/25/07	**419**	**99**	<LLD		2.97	<LLD		3.71	<MDA		1.78
05/02/07	**301**	**96**									
05/09/07	**211**	**96**									
05/16/07	**235**	**93**									
05/23/07	<203										
05/30/07	**391**	**100**	<LLD		2.94	<LLD		3.94	<MDA		1.64
06/06/07	<204										
06/13/07	**262**	**97**									
06/20/07	**286**	**97**									
06/27/07	<202		<LLD		2.77	<LLD		3.89	<MDA		2.45
07/04/07	<202										
07/11/07	<198										
07/18/07	<208										
07/25/07	**231**	**96**	<LLD		2.34	<LLD		4.01	<MDA		3.98
08/01/07	<207										
08/08/07	**330**	**103**									
08/15/07	**310**	**99**									
08/22/07	<204										
08/29/07	**262**	**95**	<LLD		3.05	<LLD		4.32	<MDA		3.98
09/05/07	<200										
09/12/07	**230**	**95**									
09/19/07	**327**	**97**									
09/26/07	**381**	**100**	<LLD		3.08	**4.69**	**1.89**	**3.30**	<MDA		1.78
10/03/07	**228**	**96**									
10/10/07	**279**	**96**									
10/17/07	<190										
10/24/07	<189										
10/31/07	**258**	**90**	<LLD		2.79	**4.53**	**2.16**	**3.93**	<MDA		1.72
11/07/07	<192										
11/14/07	<191										
11/21/07	<187										
11/28/07	<200		<LLD		2.77	<LLD		3.52	<MDA		2.49
12/05/07	**248**	**93**									
12/12/07	**259**	**87**									
12/19/07	**281**	**84**									
12/26/07	**310**	**94**									

Notes:
1. Tritium samples are weekly 80 mL composite sample 100 minute scans
2. Gross alpha, gross beta, and gamma samples are monthly composites
3. Monthly composites begin on the last Wednesday of the previous month.

Radiological Monitoring of Surface Water
Ambient Data

Four Mile Creek @ Road A-13 (SV-2039)											
Date	Tritium		Gross Alpha			Gross Beta			Cs-137		
	pCi/L	+/-2 Sigma	pCi/L	+/-2 Sigma	LLD	pCi/L	+/-2 Sigma	LLD	pCi/L	+/-2 Sigma	MDA
01/03/07	**64076**	**711**	<LLD		1.93	**6.05**	**2.23**	**3.89**	<MDA		2.00
01/10/07	**63987**	**714**									
01/17/07	**62594**	**706**									
01/24/07	**64106**	**709**									
01/31/07	**63575**	**708**	<LLD		1.95	**3.96**	**1.64**	**2.8**	<MDA		3.21
02/07/07	**53119**	**650**									
02/14/07	**55073**	**661**									
02/21/07	**55308**	**661**									
02/28/07	**55308**	**664**	<LLD		1.89	**5.51**	**2.20**	**3.89**	<MDA		3.45
03/07/07	**51167**	**637**									
03/14/07	**54763**	**659**									
03/21/07	**56646**	**658**									
03/28/07	**65533**	**720**	<LLD		1.90	**7.31**	**2.39**	**4.13**	<MDA		3.48
04/04/07	**67970**	**738**									
04/11/07	**71012**	**753**									
04/18/07	**67684**	**733**									
04/25/07	**67559**	**735**	<LLD		2.73	**4.24**	**2.03**	**3.67**	<MDA		2.15
05/02/07	**68533**	**742**									
05/09/07	**67811**	**736**									
05/16/07	**67289**	**733**									
05/23/07	**60132**	**695**									
05/30/07	**62354**	**710**	<LLD		2.72	**6.77**	**2.25**	**3.91**	<MDA		2.36
06/06/07	**55041**	**668**									
06/13/07	**55338**	**669**									
06/20/07	**58098**	**679**									
06/27/07	**58335**	**681**	<LLD		2.85	**4.14**	**2.17**	**3.96**	<MDA		2.76
07/04/07	**57227**	**679**									
07/11/07	**57502**	**673**									
07/18/07	**56620**	**675**									
07/25/07	**57475**	**680**	<LLD		2.08	<LLD		3.96	<MDA		4.00
08/01/07	**62556**	**708**									
08/08/07	**56695**	**678**									
08/15/07	**56676**	**679**									
08/22/07	**56483**	**677**									
08/29/07	**53343**	**660**	<LLD		2.74	<LLD		4.27	<MDA		3.96
09/05/07	**60643**	**696**									
09/12/07	**59930**	**691**									
09/19/07	**60980**	**697**									
09/26/07	**59645**	**687**	<LLD		2.91	**7.41**	**2.00**	**3.28**	<MDA		2.20
10/03/07	**55994**	**668**									
10/10/07	**61837**	**696**									
10/17/07	**55981**	**664**									
10/24/07	**60099**	**686**									
10/31/07	**55900**	**660**	<LLD		2.53	**4.22**	**2.13**	**3.89**	<MDA		2.29
11/07/07	**55965**	**666**									
11/14/07	**54978**	**655**									
11/21/07	**52108**	**641**									
11/28/07	**68030**	**729**	<LLD		2.48	**10.3**	**2.2**	**3.48**	<MDA		2.78
12/05/07	**61801**	**698**									
12/12/07	**55684**	**664**									
12/19/07	**56557**	**669**									
12/26/07	**55781**	**664**									

Notes:
1. Tritium samples are weekly 80 mL composite sample 100 minute scans
2. Gross alpha, gross beta, and gamma samples are monthly composites
3. Monthly composites begin on the last Wednesday of the previous month.

Radiological Monitoring of Surface Water
Ambient Data

Pen Branch @ Road A-13 (SV-2047)											
Date	Tritium		Gross Alpha			Gross Beta			Cs-137		
	pCi/L	+/-2 Sigma	pCi/L	+/-2 Sigma	LLD	pCi/L	+/-2 Sigma	LLD	pCi/L	+/-2 Sigma	MDA
01/03/07	**50910**	**635**	<LLD		2.05	**3.94**	**2.14**	**3.90**	<MDA		2.09
01/10/07	**38977**	**559**									
01/17/07	**39370**	**561**									
01/24/07	**51128**	**635**									
01/31/07	**50645**	**632**	<LLD		2.00	<LLD		2.81	<MDA		3.44
02/07/07	**33124**	**517**									
02/14/07	**32736**	**513**									
02/21/07	**31936**	**507**									
02/28/07	**32836**	**516**	**2.25**	**1.42**	**2.09**	<LLD		3.91	<MDA		2.89
03/07/07	**30639**	**497**									
03/14/07	**32301**	**511**									
03/21/07	**32581**	**513**									
03/28/07	**45936**	**605**	<LLD		2.07	<LLD		4.15	<MDA		3.22
04/04/07	**12458**	**325**									
04/11/07	**53210**	**654**									
04/18/07	**12748**	**328**									
04/25/07	**13021**	**330**	<LLD		2.97	<LLD		3.71	<MDA		1.63
05/02/07	**12504**	**325**									
05/09/07	**12935**	**331**									
05/16/07	**12546**	**325**									
05/23/07	**55121**	**664**									
05/30/07	**57380**	**680**	**5.29**	**2.59**	**3.82**	<LLD		4.05	<MDA		1.89
06/06/07	**45888**	**610**									
06/13/07	**47987**	**606**									
06/20/07	**53248**	**648**									
06/27/07	**54088**	**654**	<LLD		2.91	<LLD		4.29	<MDA		2.29
07/04/07	**46693**	**614**									
07/11/07	**46704**	**614**									
07/18/07	**46767**	**614**									
07/25/07	**46619**	**612**	**3.00**	**1.72**	**2.46**	<LLD		4.03	<MDA		3.98
08/01/07	**59864**	**694**									
08/08/07	**58172**	**684**									
08/15/07	**57883**	**684**									
08/22/07	**58249**	**685**									
08/29/07	**58884**	**688**	<LLD		3.05	<LLD		4.32	<MDA		4.00
09/05/07	**61611**	**701**									
09/12/07	**61757**	**702**									
09/19/07	**62042**	**703**									
09/26/07	**62454**	**705**	<LLD		3.07	<LLD		3.30	<MDA		1.74
10/03/07	**59520**	**688**									
10/10/07	**62651**	**700**									
10/17/07	**56312**	**667**									
10/24/07	**60846**	**689**									
10/31/07	**62115**	**697**	<LLD		2.90	<LLD		3.95	<MDA		1.83
11/07/07	**57213**	**670**									
11/14/07	**55686**	**658**									
11/21/07	**68968**	**739**									
11/28/07	**59155**	**683**	<LLD		2.71	<LLD		3.51	<MDA		2.53
12/05/07	**62104**	**701**									
12/12/07	**44022**	**593**									
12/19/07	**44457**	**595**									
12/26/07	**43715**	**590**									

Notes:
1. Tritium samples are weekly 80 mL composite sample 100 minute scans
2. Gross alpha, gross beta, and gamma samples are monthly composites
3. Monthly composites begin on the last Wednesday of the previous month.

Radiological Monitoring of Surface Water
Ambient Data

Steel Creek @ SC 125 (SV-327)											
Date	Tritium		Gross Alpha			Gross Beta			Cs-137		
	pCi/L	+/-2 Sigma	pCi/L	+/-2 Sigma	LLD	pCi/L	+/-2 Sigma	LLD	pCi/L	+/-2 Sigma	MDA
01/03/07	**2635**	**163**	<LLD		1.99	<LLD		3.89	<MDA		2.05
01/10/07	**3859**	**193**									
01/17/07	**3707**	**190**									
01/24/07	**2251**	**155**									
01/31/07	**2325**	**157**	<LLD		2.00	<LLD		2.81	<MDA		3.32
02/07/07	**2759**	**168**									
02/14/07	**2824**	**169**									
02/21/07	**2700**	**166**									
02/28/07	**2908**	**172**	<LLD		1.96	<LLD		3.9	<MDA		3.18
03/07/07	**2313**	**156**									
03/14/07	**2767**	**169**									
03/21/07	**2763**	**167**									
03/28/07	**2920**	**172**	**5.45**	**2.18**	**2.72**	<LLD		4.22	<MDA		3.55
04/04/07	**2979**	**176**									
04/11/07	**3137**	**178**									
04/18/07	**2890**	**174**									
04/25/07	**3249**	**179**	<LLD		2.86	<LLD		3.69	<MDA		2.03
05/02/07	**3670**	**190**									
05/09/07	**3498**	**188**									
05/16/07	**3431**	**185**									
05/23/07	**4543**	**208**									
05/30/07	**5420**	**223**	<LLD		2.91	<LLD		3.94	<MDA		1.73
06/06/07	**4436**	**207**									
06/13/07	**4726**	**212**									
06/20/07	**4579**	**207**									
06/27/07	**4516**	**206**	**7.08**	**3.15**	**4.41**	<LLD		4.06	<MDA		2.81
07/04/07	**4234**	**201**									
07/11/07	**4171**	**202**									
07/18/07	**4379**	**205**									
07/25/07	**4234**	**201**	<LLD		2.35	<LLD		4.01	<MDA		4.00
08/01/07	**4439**	**207**									
08/08/07	**4777**	**214**									
08/15/07	**4707**	**211**									
08/22/07	**4510**	**208**									
08/29/07	**4666**	**209**	**17.7**	**3.10**	**2.90**	<LLD		4.29	<MDA		4.00
09/05/07	**3930**	**194**									
09/12/07	**3668**	**190**									
09/19/07	**3521**	**186**									
09/26/07	**3934**	**194**	<LLD		3.30	**4.51**	**1.89**	**3.32**	<MDA		2.00
10/03/07	**4525**	**207**									
10/10/07	**3982**	**194**									
10/17/07	**3819**	**188**									
10/24/07	**4082**	**194**									
10/31/07	**4586**	**205**	<LLD		2.87	<LLD		3.94	<MDA		2.04
11/07/07	**3487**	**184**									
11/14/07	**3267**	**177**									
11/21/07	**6782**	**242**									
11/28/07	**7492**	**256**	<LLD		2.77	<LLD		3.52	<MDA		2.61
12/05/07	**8442**	**268**									
12/12/07	**7436**	**252**									
12/19/07	**7382**	**250**									
12/26/07	**7383**	**253**									

Notes:
1. Tritium samples are weekly 80 mL composite sample 100 minute scans
2. Gross alpha, gross beta, and gamma samples are monthly composites
3. Monthly composites begin on the last Wednesday of the previous month.

Radiological Monitoring of Surface Water
Ambient Data

Steel Creek Landing @ RM 141 (SV-2018)											
Date	Tritium		Gross Alpha			Gross Beta			Cs-137		
	pCi/L	+/-2 Sigma	pCi/L	+/-2 Sigma	LLD	pCi/L	+/-2 Sigma	LLD	pCi/L	+/-2 Sigma	MDA
01/03/07	**398**	**96**	<LLD		2.06	<LLD		3.90	<MDA		2.08
01/10/07	**339**	**99**									
01/17/07	**404**	**101**									
01/24/07	**255**	**93**									
01/31/07	**215**	**91**	<LLD		2.04	<LLD		2.81	<MDA		3.49
02/07/07	**773**	**112**									
02/14/07	**527**	**103**									
02/21/07	**454**	**101**									
02/28/07	**536**	**105**	<LLD		1.99	<LLD		3.9	<MDA		2.78
03/07/07	**4082**	**202**									
03/14/07	**487**	**103**									
03/21/07	**611**	**105**									
03/28/07	**2086**	**152**	<LLD		2.08	<LLD		4.15	<MDA		3.75
04/04/07	<206										
04/11/07	**272**	**96**									
04/18/07	**387**	**103**									
04/25/07	**563**	**105**	<LLD		3.01	<LLD		3.71	<MDA		1.79
05/02/07	**504**	**104**									
05/09/07	**380**	**102**									
05/16/07	**399**	**100**									
05/23/07	**233**	**96**									
05/30/07	**437**	**102**	<LLD		2.99	<LLD		3.95	<MDA		1.78
06/06/07	**372**	**102**									
06/13/07	**381**	**102**									
06/20/07	**314**	**98**									
06/27/07	**285**	**97**	<LLD		2.78	<LLD		3.89	<MDA		2.38
07/04/07	**567**	**109**									
07/11/07	**630**	**111**									
07/18/07	**475**	**107**									
07/25/07	**489**	**107**	<LLD		2.36	<LLD		4.01	<MDA		4.00
08/01/07	**389**	**104**									
08/08/07	<208										
08/15/07	**447**	**104**									
08/22/07	**238**	**97**									
08/29/07	**349**	**99**	**7.41**	**2.38**	**3.07**	<LLD		4.32	<MDA		4.00
09/05/07	**395**	**101**									
09/12/07	**402**	**102**									
09/19/07	**403**	**101**									
09/26/07	**329**	**99**	<LLD		3.08	**4.12**	**1.86**	**3.30**	<MDA		1.64
10/03/07	**327**	**100**									
10/10/07	**456**	**103**									
10/17/07	**236**	**91**									
10/24/07	**543**	**103**									
10/31/07	**534**	**102**	**10.5**	**2.57**	**2.76**	<LLD		3.93	<MDA		1.91
11/07/07	**345**	**97**									
11/14/07	**322**	**94**									
11/21/07	**480**	**99**									
11/28/07	**396**	**101**	<LLD		2.77	<LLD		3.52	<MDA		2.48
12/05/07	**262**	**94**									
12/12/07	**1017**	**116**									
12/19/07	**1243**	**121**									
12/26/07	**941**	**117**									

Notes:
1. Tritium samples are weekly 80 mL grab sample 100 minute scans.
2. Gross alpha, gross beta, and gamma samples are monthly composites.
3. Monthly composites begin on the last Wednesday of the previous month.

Radiological Monitoring of Surface Water
Ambient Data

US-301 Bridge (SV-118)											
Date	Tritium		Gross Alpha			Gross Beta			Cs-137		
	pCi/L	+/-2 Sigma	pCi/L	+/-2 Sigma	LLD	pCi/L	+/-2 Sigma	LLD	pCi/L	+/-2 Sigma	MDA
01/03/07	**485**	**99**	<LLD		2.07	<LLD		3.90	<MDA		2.01
01/10/07	**311**	**97**									
01/17/07	**414**	**100**									
01/24/07	**402**	**99**									
01/31/07	**399**	**99**	<LLD		2.08	<LLD		2.81	<MDA		3.00
02/07/07	<189										
02/14/07	**478**	**100**									
02/21/07	**476**	**101**									
02/28/07	**536**	**105**	<LLD		2.03	<LLD		3.91	<MDA		3.14
03/07/07	**571**	**105**									
03/14/07	**497**	**104**									
03/21/07	**644**	**106**									
03/28/07	**456**	**102**	<LLD		2.03	<LLD		4.15	<MDA		4.00
04/04/07	**426**	**104**									
04/11/07	**403**	**101**									
04/18/07	**558**	**109**									
04/25/07	**585**	**105**	<LLD		3.62	<LLD		3.78	<MDA		1.87
05/02/07	**612**	**108**									
05/09/07	**285**	**98**									
05/16/07	**336**	**97**									
05/23/07	**221**	**95**									
05/30/07	**256**	**94**	<LLD		4.32	<LLD		4.09	<MDA		1.82
06/06/07	<204										
06/13/07	**292**	**99**									
06/20/07	**322**	**98**									
06/27/07	**203**	**94**	<LLD		2.80	<LLD		3.90	<MDA		2.24
07/04/07	<202										
07/11/07	**262**	**95**									
07/18/07	<208										
07/25/07	**442**	**104**	**4.34**	**1.88**	**2.43**	<LLD		4.03	<MDA		3.98
08/01/07	**325**	**101**									
08/08/07	**539**	**110**									
08/15/07	**631**	**110**									
08/22/07	**597**	**111**									
08/29/07	**314**	**97**	<LLD		3.20	<LLD		4.34	<MDA		4.00
09/05/07	**226**	**94**									
09/12/07	**202**	**94**									
09/19/07	**317**	**97**									
09/26/07	**484**	**105**	<LLD		3.35	<LLD		3.33	<MDA		1.76
10/03/07	**391**	**102**									
10/10/07	**382**	**100**									
10/17/07	**442**	**100**									
10/24/07	**424**	**98**									
10/31/07	**354**	**94**	<LLD		2.80	<LLD		3.93	<MDA		1.70
11/07/07	**236**	**92**									
11/14/07	**259**	**92**									
11/21/07	**432**	**98**									
11/28/07	**226**	**94**	<LLD		2.94	**4.77**	**2.00**	**3.54**	<MDA		2.66
12/05/07	<195										
12/12/07	**531**	**99**									
12/19/07	**758**	**104**									
12/26/07	**492**	**101**									

Notes:
1. Tritium samples are weekly 80 mL composite sample 100 minute scans.
2. Gross alpha, gross beta, and gamma samples are monthly composites.
3. Monthly composites begin on the last Wednesday of the previous month.

Radiological Monitoring of Surface Water
Ambient Data

Lower Three Runs @ Road B (SV-2053)											
Date	Tritium		Gross Alpha			Gross Beta			Cs-137		
	pCi/L	+/-2 Sigma	pCi/L	+/-2 Sigma	LLD	pCi/L	+/-2 Sigma	LLD	pCi/L	+/-2 Sigma	MDA
01/03/07	**535**	**101**	<LLD		1.90	<LLD		3.88	<MDA		2.24
01/10/07	**540**	**105**									
01/17/07	**383**	**99**									
01/24/07	**316**	**95**									
01/31/07	**247**	**93**	<LLD		1.93	<LLD		2.8	<MDA		2.39
02/07/07	**356**	**95**									
02/14/07	**365**	**96**									
02/21/07	**358**	**96**									
02/28/07	**317**	**95**	<LLD		1.84	<LLD		3.89	<MDA		3.39
03/07/07	**349**	**94**									
03/14/07	**385**	**99**									
03/21/07	**507**	**101**									
03/28/07	**239**	**93**	**2.64**	**1.34**	**1.85**	<LLD		4.13	<MDA		3.69
04/04/07	<206										
04/11/07	**407**	**101**									
04/18/07	**334**	**100**									
04/25/07	**457**	**100**	<LLD		2.62	<LLD		3.66	<MDA		2.02
05/02/07	**320**	**97**									
05/09/07	<205										
05/16/07	<196										
05/23/07	**268**	**97**									
05/30/07	**299**	**96**	<LLD		2.66	<LLD		3.90	<MDA		1.92
06/06/07	**234**	**96**									
06/13/07	**301**	**98**									
06/20/07	**398**	**100**									
06/27/07	**306**	**97**	<LLD		2.59	<LLD		3.86	<MDA		2.50
07/04/07	**307**	**98**									
07/11/07	**383**	**99**									
07/18/07	**336**	**101**									
07/25/07	**443**	**104**	<LLD		2.09	<LLD		3.96	<MDA		3.28
08/01/07	**448**	**105**									
08/08/07	**488**	**109**									
08/15/07	**418**	**103**									
08/22/07	**415**	**104**									
08/29/07	**432**	**102**	<LLD		2.82	<LLD		4.28	<MDA		3.69
09/05/07	**589**	**108**									
09/12/07	**545**	**107**									
09/19/07	**428**	**102**									
09/26/07	**503**	**106**	<LLD		3.07	**3.51**	**1.83**	**3.30**	<MDA		2.41
10/03/07	**370**	**102**									
10/10/07	**437**	**103**									
10/17/07	**442**	**100**									
10/24/07	**441**	**99**									
10/31/07	**380**	**96**	<LLD		2.61	<LLD		3.90	<MDA		1.94
11/07/07	**331**	**96**									
11/14/07	**409**	**98**									
11/21/07	**528**	**102**									
11/28/07	**428**	**102**	<LLD		2.55	<LLD		3.49	<MDA		2.70
12/05/07	**548**	**105**									
12/12/07	**430**	**94**									
12/19/07	**553**	**95**									
12/26/07	**281**	**92**									

Notes:
1. Tritium samples are weekly 80 mL composite sample 100 minute scans.
2. Gross alpha, gross beta, and gamma samples are monthly composites.
3. Monthly composites begin on the last Wednesday of the previous month.

Radiological Monitoring of Surface Water
Ambient Data

Lower Three Runs and SC Highway 125 (SV-175)											
Date	Tritium		Gross Alpha			Gross Beta			Cs-137		
	pCi/L	+/-2 Sigma	pCi/L	+/-2 Sigma	LLD	pCi/L	+/-2 Sigma	LLD	pCi/L	+/-2 Sigma	MDA
08/29/07	**1523**	**138**	<LLD		3.33	<LLD		4.36	<MDA		4.00
09/05/07	**1883**	**148**									
09/12/07	**1635**	**142**									
09/19/07	**1706**	**143**									
09/26/07	**1881**	**148**	<LLD		3.58	<LLD		3.35	<MDA		1.92
10/03/07	**2306**	**160**									
10/10/07	**1728**	**143**									
10/17/07	**1937**	**145**									
10/24/07	**1805**	**142**									
10/31/07	**1883**	**144**									

Lower Three Runs and Patterson Mill Rd (SV-328)											
Date	Tritium		Gross Alpha			Gross Beta			Cs-137		
	pCi/L	+/-2 Sigma	pCi/L	+/-2 Sigma	LLD	pCi/L	+/-2 Sigma	LLD	pCi/L	+/-2 Sigma	MDA
10/31/07			<LLD		2.83	<LLD		3.94	<MDA		2.09
11/07/07	**3265**	**179**									
11/14/07	**3388**	**183**									
11/21/07	**3495**	**184**									
11/28/07	**3234**	**181**	<LLD		3.34	<LLD		3.58	<MDA		2.60
12/05/07	**2059**	**151**									
12/12/07	**2309**	**154**									
12/19/07	**2502**	**156**									
12/26/07	**2419**	**159**									

Notes:
1. Tritium samples are weekly 80 mL composite sample 100 minute scans.
2. Gross alpha, gross beta, and gamma samples are monthly composites.
3. Monthly composites begin on the last Wednesday of the previous month.

Radiological Monitoring of Surface Water
Ambient Data

Fourmile Branch @ Rd. C-7 (SV-2045)		
Date	Tritium	
	pCi/L	+/-2 Sigma
01/03/07	**157857**	**1109**
01/10/07	**132355**	**1025**
01/17/07	**131751**	**1020**
01/24/07	**157144**	**1103**
01/31/07	**157059**	**1105**
02/07/07	**116386**	**957**
02/14/07	**115455**	**951**
02/21/07	**114359**	**945**
02/28/07	**114306**	**947**
03/07/07	**132574**	**1024**
03/14/07	**115119**	**951**
03/21/07	**114121**	**945**
03/28/07	**187704**	**1226**
04/04/07	**204635**	**1283**
04/11/07	**133196**	**1032**
04/18/07	**205182**	**1283**
04/25/07	**203668**	**1279**
05/02/07	**204764**	**1286**
05/09/07	**205710**	**1284**
05/16/07	**204116**	**1281**
05/23/07	**242928**	**1386**
05/30/07	**232053**	**1366**
06/06/07	**105286**	**922**
06/13/07	**106690**	**930**
06/20/07	**247815**	**1401**
06/27/07	**245882**	**1397**
07/04/07	**123459**	**996**
07/11/07	**122675**	**992**
07/18/07	**124002**	**999**
07/25/07	**123113**	**995**
08/01/07	**114938**	**962**
08/08/07	**104094**	**931**
08/15/07	**105233**	**937**
08/22/07	**104411**	**932**
08/29/07	**91699**	**860**
09/05/07	**279986**	**1494**
09/12/07	**279865**	**1492**
09/19/07	**279921**	**1490**
09/26/07	**244428**	**1391**
10/03/07	**152688**	**1098**
10/10/07	**150450**	**1084**
10/17/07	**221800**	**1319**
10/24/07	**151122**	**1086**
10/31/07	**226979**	**1326**
11/07/07	**242662**	**1377**
11/14/07	**257519**	**1413**
11/21/07	**250049**	**1405**
11/28/07	**274854**	**1479**
12/05/07	**240513**	**1373**
12/12/07	**143592**	**1066**
12/19/07	**135514**	**1029**
12/26/07	**139127**	**1044**

SRS TNX Boat Landing (SV-2012)		
Date	Tritium	
	pCi/L	+/-2 Sigma
01/03/07	**261**	**90**
01/10/07	<196	
01/17/07	<196	
01/24/07	<195	
01/31/07	**285**	**94**
02/07/07	<189	
02/14/07	**200**	**89**
02/21/07	<193	
02/28/07	**225**	**92**
03/07/07	**202**	**89**
03/14/07	<197	
03/21/07	**212**	**89**
03/28/07	**197**	**92**
04/04/07	<206	
04/11/07	**251**	**95**
04/18/07	<206	
04/25/07	<191	
05/02/07	<197	
05/09/07	<205	
05/16/07	<196	
05/23/07	<203	
05/30/07	**212**	**92**
06/06/07	**207**	**96**
06/13/07	<204	
06/20/07	<202	
06/27/07	<202	
07/04/07	**311**	**100**
07/11/07	**343**	**95**
07/18/07	**309**	**102**
07/25/07	**326**	**101**
08/01/07	<207	
08/08/07	**235**	**99**
08/15/07	<200	
08/22/07	<204	
08/29/07	**284**	**96**
09/05/07	**256**	**95**
09/12/07	<203	
09/19/07	**238**	**94**
09/26/07	**259**	**95**
10/03/07	<204	
10/10/07	<201	
10/17/07	**289**	**93**
10/24/07	<189	
10/31/07	**218**	**89**
11/07/07	**206**	**91**
11/14/07	<191	
11/21/07	**399**	**97**
11/28/07	<200	
12/05/07	<195	
12/12/07	**1098**	**119**
12/19/07	**1191**	**119**
12/26/07	**908**	**116**

Little Hell Boat Landing (SV-2019)		
Date	Tritium	
	pCi/L	+/-2 Sigma
01/03/07	**267**	**90**
01/10/07	<196	
01/17/07	<196	
01/24/07	<195	
01/31/07	<195	
02/07/07	**730**	**110**
02/14/07	**282**	**93**
02/21/07	**387**	**98**
02/28/07	**383**	**99**
03/07/07	**620**	**108**
03/14/07	**241**	**94**
03/21/07	**424**	**98**
03/28/07	**209**	**92**
04/04/07	<206	
04/11/07	<202	
04/18/07	<206	
04/25/07	**534**	**104**
05/02/07	**571**	**107**
05/09/07	**468**	**106**
05/16/07	**462**	**103**
05/23/07	<203	
05/30/07	**219**	**93**
06/06/07	**262**	**100**
06/13/07	**286**	**100**
06/20/07	<202	
06/27/07	<202	
07/04/07	**378**	**101**
07/11/07	449	
07/18/07	<208	
07/25/07	**379**	**102**
08/01/07	**291**	**100**
08/08/07	**287**	**101**
08/15/07	**381**	**101**
08/22/07	**243**	**98**
08/29/07	**408**	**101**
09/05/07	**311**	**98**
09/12/07	**254**	**96**
09/19/07	**232**	**94**
09/26/07	**411**	**101**
10/03/07	**289**	**98**
10/10/07	<201	
10/17/07	**190**	**89**
10/24/07	**334**	**95**
10/31/07	**379**	**96**
11/07/07	<192	
11/14/07	<191	
11/21/07	**315**	**93**
11/28/07	<200	
12/05/07	**246**	**94**
12/12/07	<179	
12/19/07	**420**	**91**
12/26/07	<189	

Upper Three Runs @ Rd. 2-1 (SV-2027)		
Date	Tritium	
	pCi/L	+/-2 Sigma
01/03/07	**258**	**90**
01/10/07	<196	
01/17/07	**268**	**95**
01/24/07	<195	
01/31/07	**195**	**91**
02/07/07	<189	
02/14/07	**279**	**92**
02/21/07	<193	
02/28/07	<195	
03/07/07	**315**	**93**
03/14/07	<197	
03/21/07	**195**	**88**
03/28/07	<192	
04/04/07	<206	
04/11/07	<202	
04/18/07	**277**	**99**
04/25/07	**234**	**91**
05/02/07	**331**	**98**
05/09/07	<205	
05/16/07	<196	
05/23/07	**224**	**95**
05/30/07	**257**	**94**
06/06/07	<204	
06/13/07	<204	
06/20/07	**300**	**98**
06/27/07	<202	
07/04/07	<202	
07/11/07	**279**	**97**
07/18/07	**232**	**97**
07/25/07	**211**	**95**
08/01/07	**234**	**97**
08/08/07	<208	
08/15/07	**232**	**95**
08/22/07	**215**	**96**
08/29/07	**216**	**93**
09/05/07	**224**	**94**
09/12/07	**249**	**96**
09/19/07	**312**	**97**
09/26/07	<201	
10/03/07	<204	
10/10/07	<201	
10/17/07	<190	
10/24/07	**263**	**91**
10/31/07	<186	
11/07/07	<192	
11/14/07	**287**	**94**
11/21/07	**318**	**93**
11/28/07	**205**	**93**
12/05/07	**262**	**94**
12/12/07	<179	
12/19/07	**199**	**80**
12/26/07	<189	

Notes:

1. Tritium samples are weekly 80 mL grab sample 100 minute scans

Radiological Monitoring of Surface Water
Boat Run Data

Upper Three Runs @ RM 157.4 SV-2011		
Date	pCi/L	+/-2 Sigma
02/05/07	**629**	**108**
05/07/07	**7601**	**260**
08/27/07	**5780**	**226**
11/05/07	**333**	**96**

Beaver Dam Creek @ RM 152.3 SV-2013		
Date	pCi/L	+/-2 Sigma
02/05/07	<196	
05/07/07	**255**	**96**
08/27/07	**209**	**90**
11/05/07	<192	

Four Mile Creek @ RM 150.6 SV-2015						
	At Creek Mouth (CM)		30 Feet from CM		150 Feet from CM	
Date	pCi/L	+/-2 Sigma	pCi/L	+/-2 Sigma	pCi/L	+/-2 Sigma
02/05/07	**48650**	**620**	**46037**	**602**	**36957**	**540**
05/07/07	**55238**	**669**	**18361**	**390**	**19481**	**401**
08/27/07	**51539**	**638**	**40177**	**564**	**11222**	**306**
11/05/07	**59726**	**689**	**3313**	**180**	**8180**	**265**

Steel Creek @ RM 141.8 SV-2017		
Date	pCi/L	+/-2 Sigma
02/05/07	**11863**	**321**
05/07/07	**4131**	**201**
08/27/07	**4096**	**195**
11/05/07	**2420**	**158**

Lower Three Runs @ RM 129 SV-2020		
Date	pCi/L	+/-2 Sigma
02/05/07	**641**	**109**
05/07/07	**1146**	**128**
08/27/07	**1545**	**136**
11/05/07	**1533**	**136**

Notes:
1. Grab samples collected quarterly.

Radiological Monitoring of Surface Water
Random Sample Data

Environmental Samples 2007

Sample Location	Collection Date	Tritium pCi/L	Tritium +/-2 Sigma	Date Analyzed	Gross Alpha pCi/L	Gross Alpha +/-2 Sigma	Gross Alpha LLD	Gross Beta pCi/L	Gross Beta +/-2 Sigma	Gross Beta LLD	Date Analyzed	Cs-137 pCi/L	Cs-137 +/-2 Sigma	Cs-137 MDA	Date Analyzed
RWE7	13 FEB 07	<196		25 FEB 07	<LLD		1.84	<LLD		4.16	10 MAY 07	<MDA		3.12	20 MAR 07
RWE42	13 FEB 07	<196		25 FEB 07	<LLD		1.84	<LLD		4.16	09 MAY 07	<MDA		3.38	19 MAR 07
RWE10*	13 MAR 07	<200		22 APR 07	<LLD		2.78	<LLD		3.79	13 APR 07	<MDA		2.09	04 APR 07
RWE18	13 MAR 07	<200		22 APR 07	<LLD		1.58	<LLD		3.77	13 APR 07	<MDA		2.04	05 APR 07
RWE56	13 MAR 07	<200		22 APR 07	<LLD		2.6	<LLD		3.78	13 APR 07	<MDA		1.87	05 APR 07
RWE26	27 MAR 07	<200		22 APR 07	<LLD		2.08	<LLD		3.91	03 MAY 07	<MDA		2.06	17 APR 07
RWE25	27 MAR 07	<200		22 APR 07	<LLD		2.18	<LLD		3.92	04 MAY 07	<MDA		2.08	17 APR 07
RWE12	27 MAR 07	<200		22 APR 07	<LLD		2.03	<LLD		3.91	04 MAY 07	<MDA		1.91	17 APR 07
RWE15	*Not sampled; no accessible water source														
RWE14	18 SEP 07	<189		14 DEC 07	<LLD		2.47	<LLD		4.21	15 DEC 07	<MDA		3.99	19 OCT 07
RWE27	19 SEP 07	<189		14 DEC 07	<LLD		2.65	<LLD		4.25	15 DEC 07	<MDA		4.00	23 OCT 07
RWE30*	19 SEP 07	<189		14 DEC 07	<LLD		2.54	<LLD		4.23	15 DEC 07	<MDA		4.00	23 OCT 07
RWE20	13 DEC 07	<183		26 JAN 08	**2.44**	**1.45**	**2.19**	<LLD		3.52	06 FEB 08	<MDA		2.49	25 FEB 08
RWE8	13 DEC 07	<183		26 JAN 08	<LLD		2.32	<LLD		3.55	07 FEB 08	<MDA		2.47	25 FEB 08
RWE17	13 DEC 07	<183		26 JAN 08	<LLD		2.24	<LLD		3.53	07 FEB 08	<MDA		2.50	25 FEB 08
RWE16	18 DEC 07	<183		26 JAN 08	<LLD		3.19	<LLD		3.67	07 FEB 08	<MDA		2.59	26 FEB 08
RWE21	18 DEC 07	<183		26 JAN 08	<LLD		3.09	<LLD		3.66	07 FEB 08	<MDA		2.40	27 FEB 08
RWE1	20 DEC 07	<183		26 JAN 08	**6.80**	**2.82**	**3.78**	<LLD		3.72	08 FEB 08	<MDA		1.87	13 MAR 08
RWE2	20 DEC 07	**265**	**91**	26 JAN 08	<LLD		2.64	<LLD		3.60	08 FEB 08	<MDA		1.72	13 MAR 08
RWE3	20 DEC 07	<183		26 JAN 08	<LLD		2.27	<LLD		3.54	08 FEB 08	<MDA		1.90	14 MAR 08
RWE4	31 DEC 07	<183		26 JAN 08	**3.14**	**1.60**	**2.31**	<LLD		3.54	08 FEB 08	<MDA		1.64	17 MAR 08

Background Samples 2007

Sample Location	Collection Date	Tritium pCi/L	Tritium +/-2 Sigma	Date Analyzed	Gross Alpha pCi/L	Gross Alpha +/-2 Sigma	Gross Alpha LLD	Gross Beta pCi/L	Gross Beta +/-2 Sigma	Gross Beta LLD	Date Analyzed	Cs-137 pCi/L	Cs-137 +/-2 Sigma	Cs-137 MDA	Date Analyzed
RWB39*	13 FEB 07	<196		25 FEB 07	<LLD		2.12	<LLD		4.20	10 MAY 07	<MDA		3.24	20 MAR 07
RWB24	13 FEB 07	<196		25 FEB 07	<LLD		2.15	<LLD		4.20	10 MAY 07	<MDA		3.31	21 MAR 07
RWB16	27 FEB 07	<200		22 APR 07	<LLD		2.13	<LLD		2.96	28 MAR 07	<MDA		1.96	16 MAR 07
RWB17	27 FEB 07	<200		22 APR 07	<LLD		2.13	<LLD		2.97	28 MAR 07	<MDA		1.94	19 MAR 07
RWB1	27 FEB 07	<200		22 APR 07	<LLD		2.01	<LLD		2.95	28 MAR 07	<MDA		2.13	15 MAR 07
RWB45	27 FEB 07	<200		22 APR 07	<LLD		2.18	<LLD		2.96	28 MAR 07	<MDA		2.10	15 MAR 07
RWB46*	27 FEB 07	<200		22 APR 07	<LLD		2.11	<LLD		2.96	28 MAR 07	<MDA		1.99	16 MAR 07
RWB58	27 FEB 07	<200		22 APR 07	<LLD		2.19	<LLD		2.97	28 MAR 07	<MDA		1.98	16 MAR 07
RWB5	06 MAR 07	<195		13 MAR 07	<LLD		2.20	<LLD		2.82	15 APR 07	<MDA		3.28	28 MAR 07
RWB13	06 MAR 07	<195		13 MAR 07	<LLD		2.29	<LLD		2.83	15 APR 07	<MDA		2.78	29 MAR 07
RWB4	13 MAR 07	**204**	**94**	22 APR 07	<LLD		221	**244**	**111**	**199**	13 APR 07	<MDA		1.99	04 APR 07
RWB27	27 MAR 07	<200		22 APR 07	<LLD		2.26	<LLD		3.93	03 MAY 07	<MDA		2.01	16 APR 07
RWB35*	27 MAR 07	<200		22 APR 07	<LLD		2.22	<LLD		3.93	03 MAY 07	<MDA		2.23	16 APR 07
RWB6	22 AUG 07	<189		14 DEC 07	<LLD		2.82	<LLD		4.28	15 DEC 07	<MDA		4.00	18 OCT 07
RWB7	22 AUG 07	<189		14 DEC 07	<LLD		2.75	<LLD		4.27	15 DEC 07	<MDA		3.98	19 OCT 07
RWB11	11 DEC 07	<183		26 JAN 08	<LLD		2.99	<LLD		3.64	06 FEB 08	<MDA		2.35	21 FEB 08
RWB10*	11 DEC 07	**279**	**89**	26 JAN 08	<LLD		2.78	<LLD		3.62	06 FEB 08	<MDA		2.46	22 FEB 08
RWB9	11 DEC 07	<183		26 JAN 08	<LLD		3.19	<LLD		3.67	06 FEB 08	<MDA		2.52	22 FEB 08
RWB3	13 DEC 07	<183		26 JAN 08	<LLD		2.84	<LLD		3.63	07 FEB 08	<MDA		2.60	26 FEB 08
RWB12	13 DEC 07	<183		26 JAN 08	<LLD		3.53	<LLD		3.70	07 FEB 08	<MDA		2.53	26 FEB 08
RWB2*	20 DEC 07	<183		26 JAN 08	**4.05**	**2.40**	**3.63**	**6.17**	**2.15**	**3.71**	08 FEB 08	<MDA		2.01	13 MAR 08

Back to List of Data Tables

2.3.5 Summary Statistics

Radiological Monitoring of Surface Water

Tritium **117**

Gross Alpha **118**

Gross Beta **119**

Back to List of Statistical Summaries

Summary Statistics
Radiological Monitoring of Surface Water

Tritium Data for Ambient Monitoring Locations

Sample Location	Average Concentration (pCi/L)	Standard Deviation	Median	Maximum Concentration (pCi/L)	Minimum Concentration (pCi/L)	Number of Samples	Number of Detects
Jackson Landing (SV-2010)	255	61	236	364	190	52	10
Four Mile Creek (SV-2045)	172,554	59,128	151,905	279,986	91,699	52	52
Upper Three Runs (SV-325)	1,930	1,365	1,812	7,258	391	52	52
TNX Boat Landing (SV-2012)	351	271	258	1,191	197	52	26
Beaver Dam Creek (SV-2040)	313	67	310	455	207	52	35
Four Mile Creek (SV-2039)	59,594	4,971	57,800	71,012	51,167	52	52
Pen Branch (SV-2047)	46,360	15,700	50,778	68,968	12,458	52	52
Steel Creek (SV-327)	4,147	1,441	3,932	8,442	2,251	52	52
Steel Creek Boat Landing (SV-2018)	558	592	403	4,082	215	52	50
Little Hell Landing (SV-2019)	358	123	334	730	190	52	35
Highway 301 Bridge (SV-118)	413	135	414	758	202	52	47
Lower Three Runs and SC Highway 125 (SV-175)	1,829	212	1,843	2,306	1,523	10	10
Lower Three Runs and Patterson Mill Rd. (SV-328)	2,834	567	2,868	3,495	2,059	8	8
Lower Three Runs (SV-2053)	399	90	398	589	234	52	49
Upper Three Runs (SV-2027)	253	40	253	331	195	52	28
Upper Three Runs (SV-2011) Creek Mouth	3,586	3,663	3,205	7,601	333	4	4
Beaver Dam Creek (SV-2013) Creek Mouth	232	33	232	255	209	4	2
Four Mile Creek (SV-2015) Creek Mouth	53,788	4,790	53,389	59,726	48,650	4	4
Four Mile Creek (SV-2015) 30' downstream from Creek Mouth	26,972	19,763	29,269	46,037	3,313	4	4
Four Mile Creek (SV-2015) 150' downstream from Creek Mouth	18,960	12,913	15,352	36,957	8,180	4	4
Steel Creek (SV-2017) Creek Mouth	5,628	4,233	4,114	11,863	2,420	4	4
Lower Three Runs (SV-2020) Creek Mouth	1,216	426	1,340	1,545	641	4	4

Sample Location	Average Concentration (pCi/L)	Standard Deviation	Median	Maximum Concentration (pCi/L)	Minimum Concentration (pCi/L)	Number of Samples	Number of Detects
Random Perimeter (< 50 Miles)	265	NA	265	NA	NA	21	1
Random Background (> 50 Miles)	242	53	242	279	204	21	2

Tritium Data for Random Samples

Notes:
(1) SV-175 was only sampled for the months of September and October. Sampling location was moved to SV-328
for November and December.
(2) NA = Not Applicable
(3) pCi/L = picocuries per Liter

Summary Statistics
Radiological Monitoring of Surface Water

Gross Alpha Data for Ambient Monitoring Locations

Sample Location	Average Concentration (pCi/L)	Standard Deviation	Median	Maximum Concentration (pCi/L)	Minimum Concentration (pCi/L)	Number of Samples	Number of Detects
Jackson Landing (SV-2010)	ND	NA	NA	NA	NA	12	0
Upper Three Runs (SV-325)	4.89	2.80	3.55	10.80	2.56	12	11
Beaver Dam Creek (SV-2040)	ND	NA	NA	NA	NA	12	0
Four Mile Creek (SV-2039)	ND	NA	NA	NA	NA	12	0
Pen Branch (SV-2047)	3.51	1.58	3.00	5.29	2.25	12	3
Steel Creek (SV-327)	10.08	6.65	7.08	17.70	5.45	12	3
Steel Creek Boat Landing (SV-2018)	8.96	2.18	8.96	10.50	7.41	12	2
Highway 301 Bridge (SV-118)	4.34*	1.88*	4.34*	NA	NA	12	1
Lower Three Runs and SC Highway 125 (SV-175)	ND	NA	NA	NA	NA	10	0
Lower Three Runs and Patterson Mill Rd. (SV-328)	ND	NA	NA	NA	NA	8	0
Lower Three Runs (SV-2053)	2.64*	1.34*	2.64*	NA	NA	12	1

Gross Alpha Data for Random Samples

Sample Location	Average Concentration (pCi/L)	Standard Deviation	Median	Maximum Concentration (pCi/L)	Minimum Concentration (pCi/L)	Number of Samples	Number of Detects
Random Perimeter (< 50 Miles)	4.13	2.34	3.14	6.80	2.44	21	3
Random Background (> 50 Miles)	4.05*	2.40*	4.05*	NA	NA	21	1

Notes:
(1) SV-175 was only sampled for the months of September and October. Sampling location was moved to SV-328 for November and December.
(2) pCi/L= picocuries per Liter
(3) ND = No Detect
(4) NA= Not Applicable
(5) "*" Denotes actual value and uncertainty (±2sd) for one detection for sampling location.

Summary Statistics
Radiological Monitoring of Surface Water

Gross Beta Data for Ambient Monitoring Locations

Sample Location	Average Concentration (pCi/L)	Standard Deviation	Median	Maximum Concentration (pCi/L)	Minimum Concentration (pCi/L)	Number of Samples	Number of Detects
Jackson Landing (SV-2010)	4.20*	2.15*	4.20*	NA	NA	12	1
Upper Three Runs (SV-325)	4.20*	2.17*	4.20*	NA	NA	12	1
Beaver Dam Creek (SV-2040)	4.78	0.31	4.69	5.12	4.53	12	3
Four Mile Creek (SV-2039)	5.99	2.03	5.78	10.30	3.96	12	10
Pen Branch (SV-2047)	3.94*	2.14*	3.94*	NA	NA	12	1
Steel Creek (SV-327)	4.51*	1.89*	4.51*	NA	NA	12	1
Steel Creek Boat Landing (SV-2018)	4.12*	1.86*	4.12*	NA	NA	12	1
Highway 301 Bridge (SV-118)	4.77*	2.00*	4.77*	NA	NA	12	1
Lower Three Runs and SC Highway 125 (SV-175)	ND	NA	NA	NA	NA	12	0
Lower Three Runs and Patterson Mill Rd. (SV-328)	ND	NA	NA	NA	NA	8	0
Lower Three Runs (SV-2053)	3.51*	1.83*	3.51*	NA	NA	12	1

Gross Beta Data for Random Samples

Sample Location	Average Concentration (pCi/L)	Standard Deviation	Median	Maximum Concentration (pCi/L)	Minimum Concentration (pCi/L)	Number of Samples	Number of Detects
Random Perimeter (< 50 Miles)	ND	NA	NA	NA	NA	21	0
Random Background (> 50 Miles)	125.09	168.17	125.09	244	6.17	21	2

Notes:
(1) SV-175 was only sampled for the months of September and October. Sampling location was moved to SV-328 for November and December.
(2) pCi/L= picocuries per Liter
(3) ND = No Detect
(4) NA= Not Applicable
(5) "*" Denotes actual value and uncertainty (±2sd) for one detection for sampling location.

Back to List of Statistical Summaries

2.4 Nonradiological Monitoring of Surface Water

2.4.1 Summary

The streams located on the Savannah River Site (SRS) receive treated wastewater and nonpoint source runoff from on-site facilities. Recent and historical data from SRS Environmental Reports indicate that the SRS surface waters are in accordance with Freshwaters Standard guidelines stated in the South Carolina Department of Health and Environmental Control (SCDHEC) Water Classifications and Standards (Regulation 61-68), (SCDHEC 1998a).

The Environmental Surveillance Oversight Program (ESOP) assessed the surface water quality for nonradiological parameters in 2007 at SRS by sampling the on-site streams for inorganic and organic contaminants. Specific parameters were analyzed monthly and bi-annually. Sampling locations were strategically chosen to monitor ambient surface water conditions to detect the nonradiological impact from the Department of Energy – Savannah River (DOE-SR) operations.

Water quality on the SRS for nonradiological parameters meets the Freshwaters Standard for South Carolina streams. Streams are tested for these parameters on a monthly interval; pH, temperature, dissolved oxygen (DO), alkalinity, turbidity, biochemical oxygen demand (BOD), total suspended solids (TSS), fecal coliform (MFC), ammonium, nitrite, nitrate, total phosphorous, and Total Kjeldahl Nitrogen (TKN). Cadmium (Cd), chromium (Cr), copper (Cu), chromium (Cr), iron (Fe), mercury (Hg), manganese (Mn), nickel (Ni), lead (Pb), zinc (Zn), total organic carbon (TOC), and volatile organic carbons (VOC) were sampled bi-annually. These are some of the same parameters used to sample streams around South Carolina (SCDHEC 2005b). Historically, all but two of the surface water parameters, nitrate and pH, continued to be within expected ranges for South Carolina streams (SCDHEC 2006c) (WSRC 2008a). Nitrate concentrations from the Four Mile Creek (SV-326) sample location were higher than comparable South Carolina streams. These elevated nitrate concentrations possibly result from the wastewater treatment facility and the E-Area groundwater plume seep line, which both discharge into Four Mile Creek upstream from this location (Smith 2008). Surface water pH from a few of the sampling locations displayed lower pH levels than typical South Carolina streams. This trend is typical for blackwater streams, such as Upper Three Runs (USGS 2000). Data from ESOP surface water locations were compared to DOE-SR data where sample points were colocated (SCDHEC 2006c) (WSRC 2008a). There were no notable differences between the ESOP and DOE-SR surface water data.

RESULTS AND DISCUSSION

pH

ESOP field personnel recorded pH at each sample location during each sampling event. All surface water data can be found in Section 2.4.4. The Freshwaters pH standard for South Carolina is between 6.0 and 8.5 (SCDHEC 2007c). Measurements below the standard range for pH were observed at Upper Three Runs (SV-2027), Lower Three Runs at Patterson Mill Road (SV-328), Four Mile Creek at Gravel Road across from H-Area (SV-2030), Upper Three Runs at Road 2-1 (SV- 2027), and Upper Three Runs at Highway 125 (SV-325). A blackwater river is a river with a deep, slow-moving channel that flows through forested swamps and wetlands.

Decaying vegetation in the water results in the leaching of tannins from the vegetation, resulting in transparent, acidic water that is darkly stained, resembling tea or coffee. Low pH is typical for black water streams, such as those sampled at SRS (USGS 2000).

Dissolved Oxygen

Dissolved Oxygen measurements were recorded at each sample location as part of each sampling event. Freshwaters DO Standard for South Carolina Streams are to have a daily average no less than 5.0 milligrams per Liter (mg/L) with a minimum of 4.0 mg/L (SCDHEC 2007c). Two sample locations had observed ranges lower than the standard: Four Mile Creek at Road A-7 (SV-326) and Four Mile Creek at Gravel Road across from H-Area (SV-2030), but their average was in the desired range for freshwater streams.

Fecal Coliform

ESOP field personnel collected surface water samples for fecal coliform analysis at each location during each sampling event. According to the SC freshwater fecal coliform standard, five consecutive stream samples during any 30 day period shall not exceed a geometric mean of 200 colonies/100 milliliters (mL) of fecal coliform, nor shall more than ten percent of total samples during any 30 day period exceed 400 colonies/100 mL of fecal coliform (SCDHEC 2007c). Since ESOP does not collect samples every day of the month, this standard cannot accurately be used to analyze the results for this parameter. However, none of the locations had a yearly average for fecal coliform that exceeded 400 colonies/100mL fecal coliform.

Nitrate/Nitrite

Two additional sampling locations were added in 2007 (SV-2030 and SV-2045) to better understand the source of the elevated nitrate/nitrite levels. Nitrate/nitrite concentrations above the State average of 0.639 mg/L were observed from monthly samples collected at the Four Mile Creek (SV-326) and Four Mile Creek at Road C-4 (SV-2045) locations; however, normal nitrate/nitrite levels were observed at Four Mile Creek at Gravel Road across from H-Area (SV-2030) (Section 2.4.3, Table 1) (SCDHEC 2007c). The average nitrate/nitrite concentration at Four Mile Creek location (SV-326) was 3.039 (± 3.133) mg/L, which increased from the 2006 average of 1.899 (± 1.579) mg/L and Four Mile Creek location SV-2045 was 1.086 (± 0.308) (SCDHEC 2006c).

On August 12, 2008, an official letter was sent from Washington Savannah River Company (WSRC) to the United States Environmental Protection Agency (USEPA) explaining the cause of higher nitrate/nitrite levels in Four Mile Creek. The elevated nitrate/nitrite levels are explained by the wastewater treatment plant, located upstream from the sampling location, or from groundwater beneath F-Area and H-Area seepage basins outcropping into Four Mile Creek (Till et al. 2001) (Smith 2008). However, the observed levels of nitrate are still below the USEPA drinking water standard of 10 mg/L Maximum Contaminant Level (MCL) and the nitrite levels were at the MCL of 1 mg/L for drinking water standards (USEPA 2003).

Other Parameters

Samples were also analyzed for other parameters; including, but not limited to alkalinity, metals, total organic carbon, VOC, pesticides and polychlorinated biphenyl (PCB); indicating that the SRS streams met the established freshwater standards during this study (SCDHEC 2006c). All surface water data are located in Section 2.4.4. Surface water statistical analyses can be found in Section 2.4.5.

Sampling locations: SV-2027, SV-325, SV-327, SV-328, SV-2047, SV-324, and SV-2030, were colocated with SRS sampling locations. Comparisons were made with the colocated sampling locations to see if there were any significant statistical differences. All colocated stations had data within one standard deviation with the exception of four: SV-2030 for Total Phosphate concentration; SV-328 for TOC concentration; SV-325 for iron content; and SV-328 for Manganese levels. Also, SCDHEC data for locations SV-2027 and SV-324 were lower than the level of detection (<LLD) and were not available for statistical analysis for either Manganese or Total Organic Carbon. Zinc data revealed a <LLD for location SV-2047. All the <LLD's were left out of the graphs for lack of numerical data. The discrepancies in data between DOE-SR and SCDHEC data can be attributed to error in sampling, sample preservation, and lab analysis. The data collected between DOE-SR and SCDHEC at colocated sites are statistically significant.

CONCLUSIONS AND RECOMMENDATIONS

ESOP nitrate/nitrite concentrations from Four Mile Creek (SV-326 and SV-2045) were higher than the average nitrate/nitrite levels measured at the other eight locations. These higher nitrate/nitrite levels are a possible result of discharge from the wastewater treatment plant, since no elevated nitrate levels were found in SV-2030 upstream from the treatment plant (Smith 2008) (WSRC 2008a). The maximum nitrate/nitrite concentration observed at SV-326 during 2007 was 12.0 mg/L, with an average concentration of 3.039 mg/L for all 2007 samples collected. The maximum nitrate/nitrite concentration observed at SV-2045 during 2007 was 1.500 mg/L, with an average concentration of 1.089 mg/L for all 2007 samples collected. All samples taken, but one, were below the USEPA National Primary Drinking Water Standard MCL of 10 mg/L for nitrate/nitrite concentrations (USEPA 2003). Overall, the nonradiological water quality on the SRS compares favorably with the South Carolina Freshwaters Standard for the parameters and locations monitored in this study.

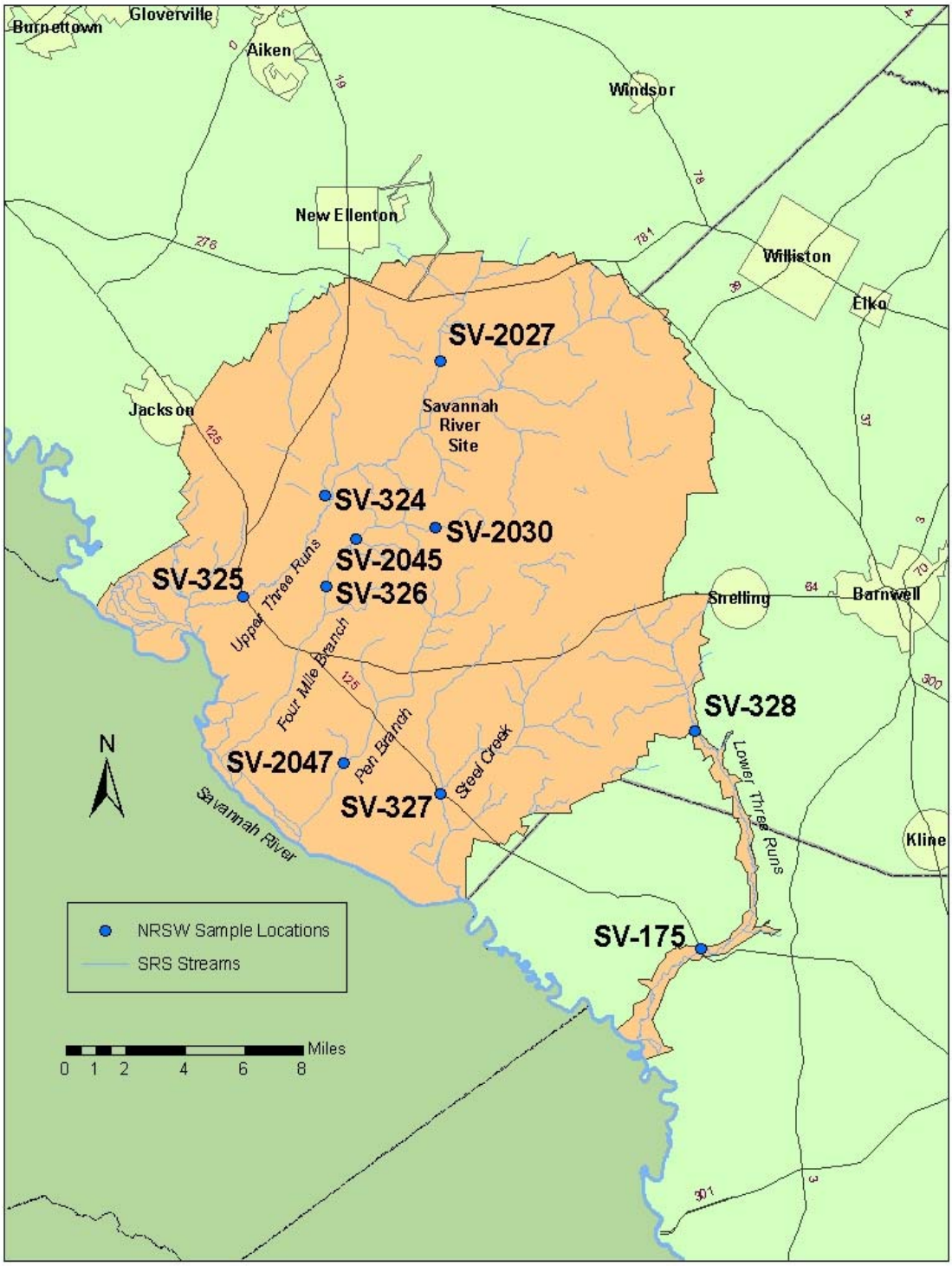
South Carolina state averages are from the Summary of Selected Water Quality Parameter Concentrations in South Carolina Water and Sediments (SCDHEC 1998b). The state averages will continue to be used as comparison data.

ESOP will continue the nonradiological independent monitoring and surveillance of SRS surface water to verify and validate water quality. Continued monitoring is required because of increased land disturbance from accelerated clean-up, new facility construction, logging, and new missions. The locations, numbers of samples, sample frequencies and monitoring parameters are reviewed and modified annually to maximize available resources and address SRS mission changes.

Back to Table of Contents

2.4.2

Map 6. Nonradiological Surface Water (NRSW) Monitoring Sample Locations Back to Maps



2.4.3 Tables and Figures
Nonradiological Monitoring of Surface Water

Table 1: ESOP Nonradiological Surface Water Sample Locations		
Sample Location	**Location Description**	**Location Rationale**
SV-2027	Upper Three Runs at Road 2-1	Background Sample
SV-324	Tim's Branch at Road C	Downstream from M- & A-Areas
SV-326	Four Mile Creek at Road A-7	Downstream from F- & H-Areas and Central Sanitation Wastewater Facility
SV-325	Upper Three Runs at Highway 125	Downstream from F-Area
SV-2047	Pen Branch at Risher Rd	Downstream from K-Area
SV-327	Steel Creek at Highway 125	Downstream from L-Lake
SV-175	Lower Three Runs at Highway 125	Downstream from Par Pond
SV-328	Lower Three Runs at Patterson Mill Road	Downstream from Par Pond
SV-2030	Four Mile Creek at Gravel Road across from H-Area	Upstream from F- & H- Areas
SV-2045	Four Mile Creek at Road C-4	Upstream from Central Sanitation Wastewater Facility

Table 2: Water Quality Parameter Analyses for ESOP		
Laboratory	Frequency	Parameter
Aiken Lab	Monthly (Surface Water)	Turbidity, Alkalinity, BOD, Fecal Coliform, and TSS.
Columbia Lab	Monthly (Surface Water)	Ammonium, Nitrite/Nitrate, Total Phosphorus, and TKN
	Semiannual (Surface Water)	Heavy Metals, TOC, and VOC
	Annually (Surface Water)	Pesticides and Polychlorinated biphenyl (PCB)
Field	Monthly (Surface Water)	Temperature, pH, and DO.

(SCDHEC 2005b)

Tables and Figures
Nonradiological Monitoring of Surface Water
Figure 1

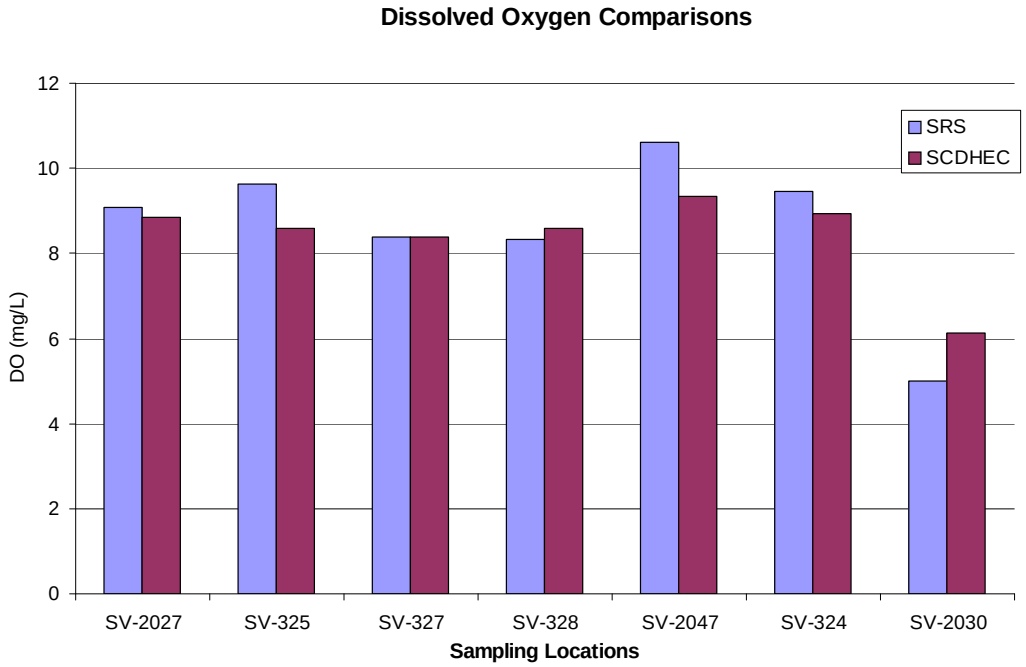
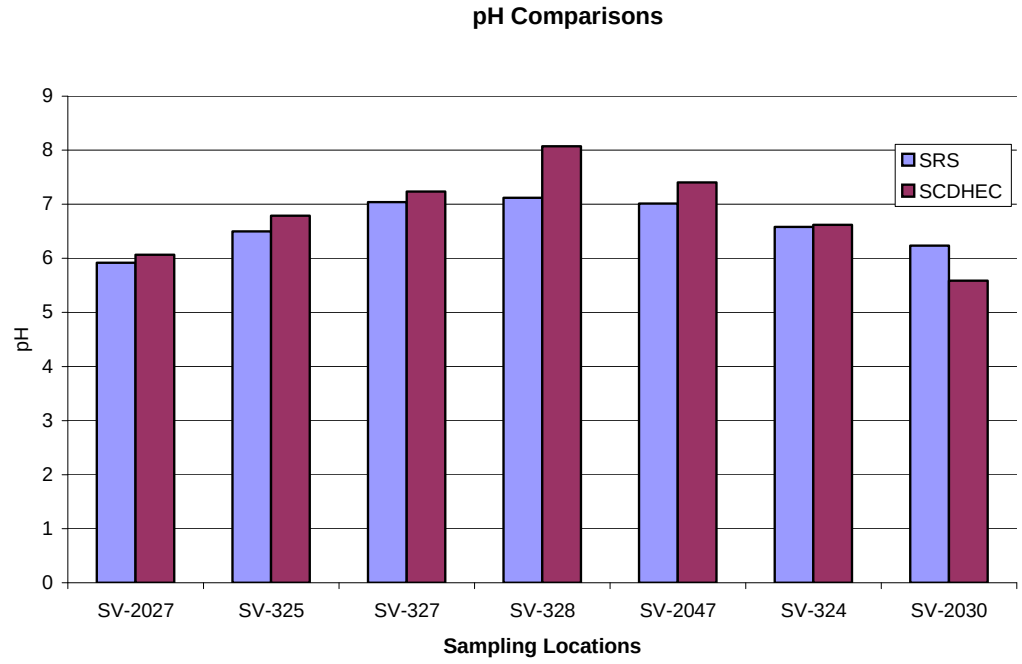


Figure 2



Tables and Figures
Nonradiological Monitoring of Surface Water
Figure 3

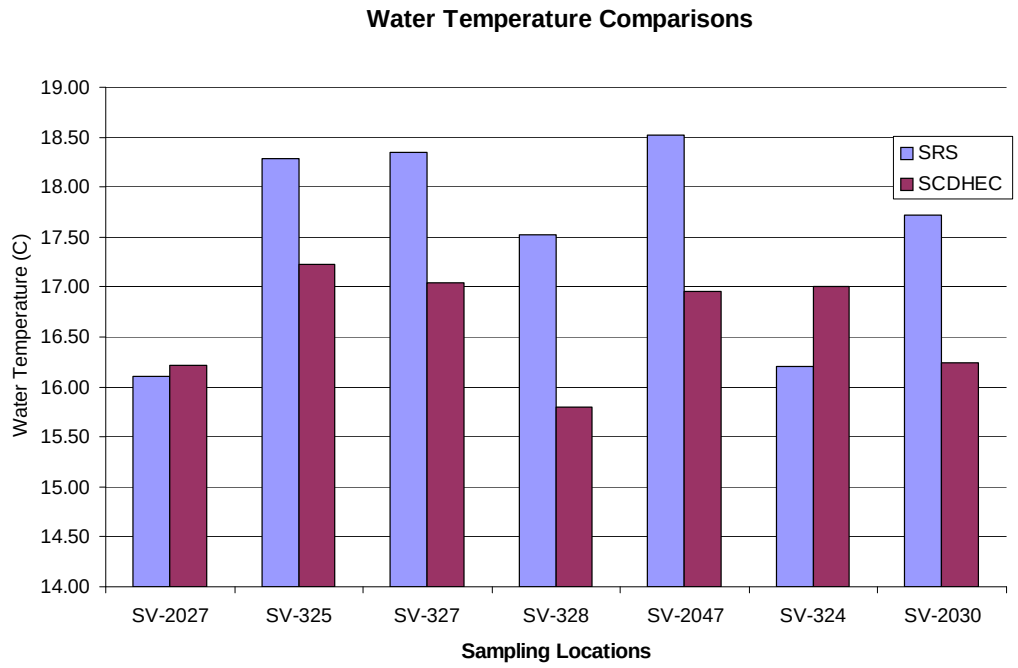
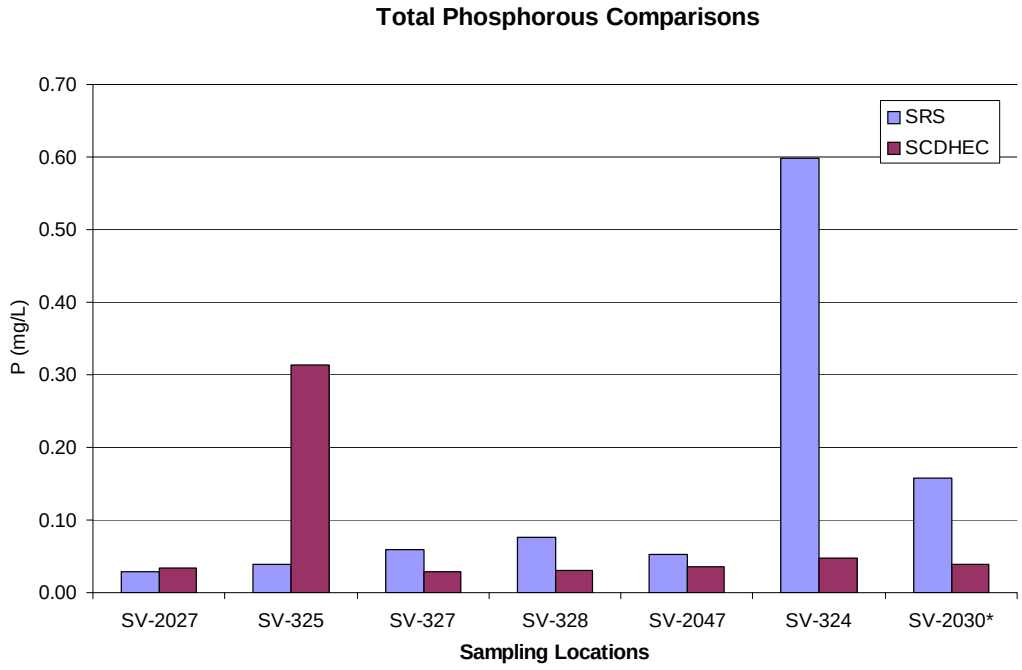


Figure 4



Tables and Figures
Nonradiological Monitoring of Surface Water
Figure 5

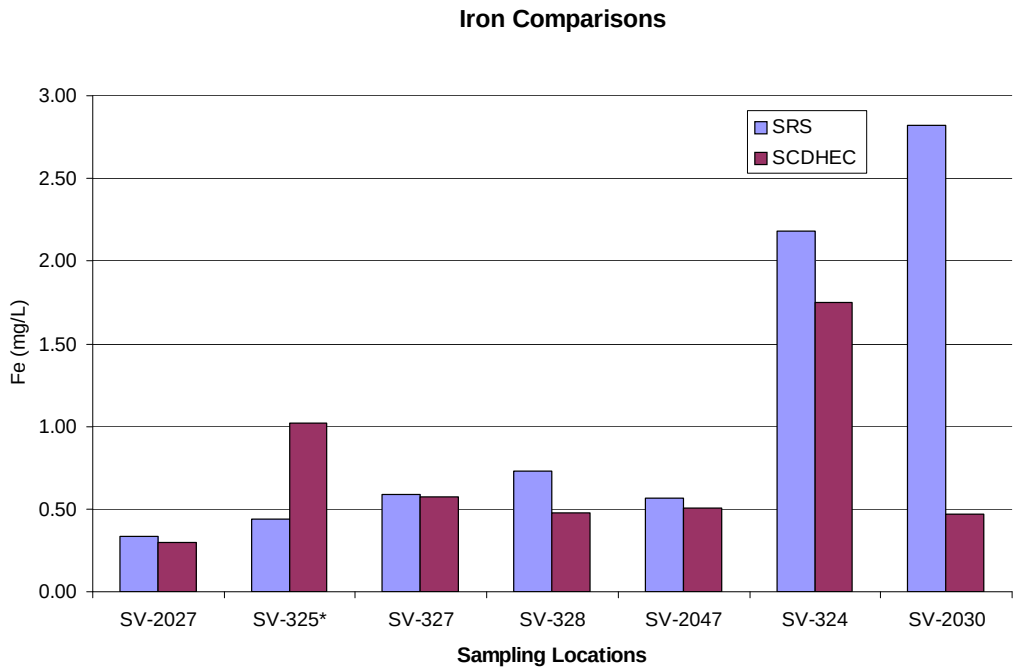
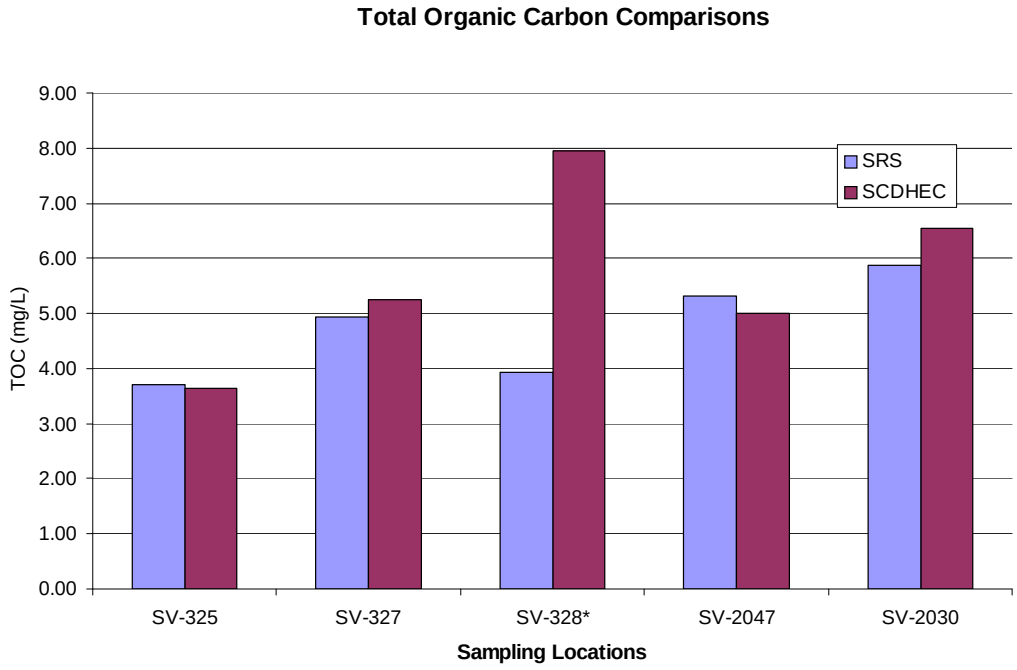


Figure 6



Tables and Figures
Nonradiological Monitoring of Surface Water
Figure 7

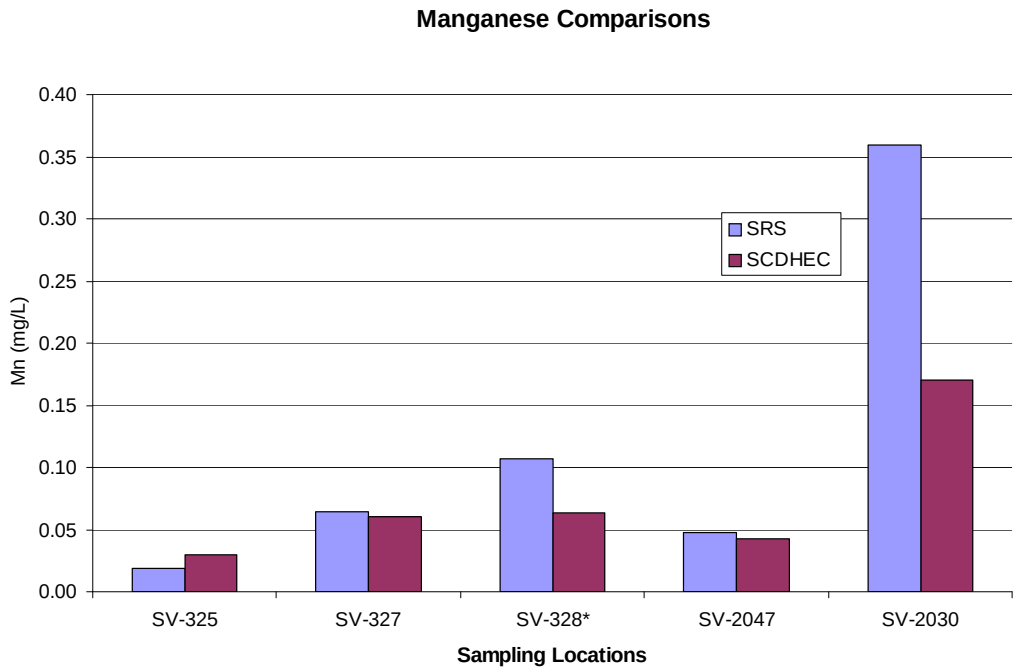
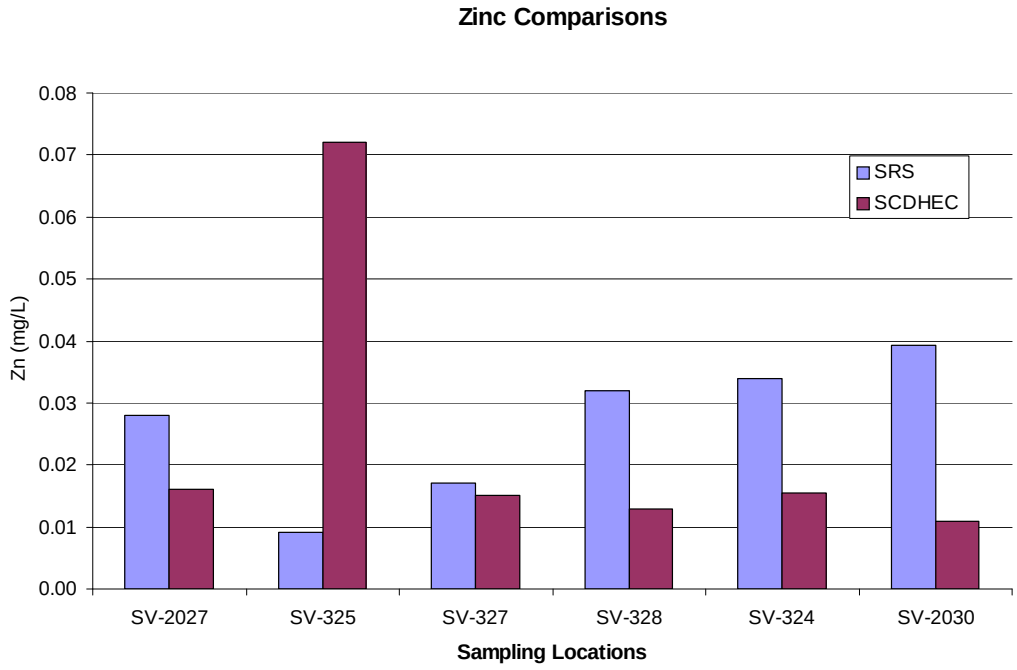
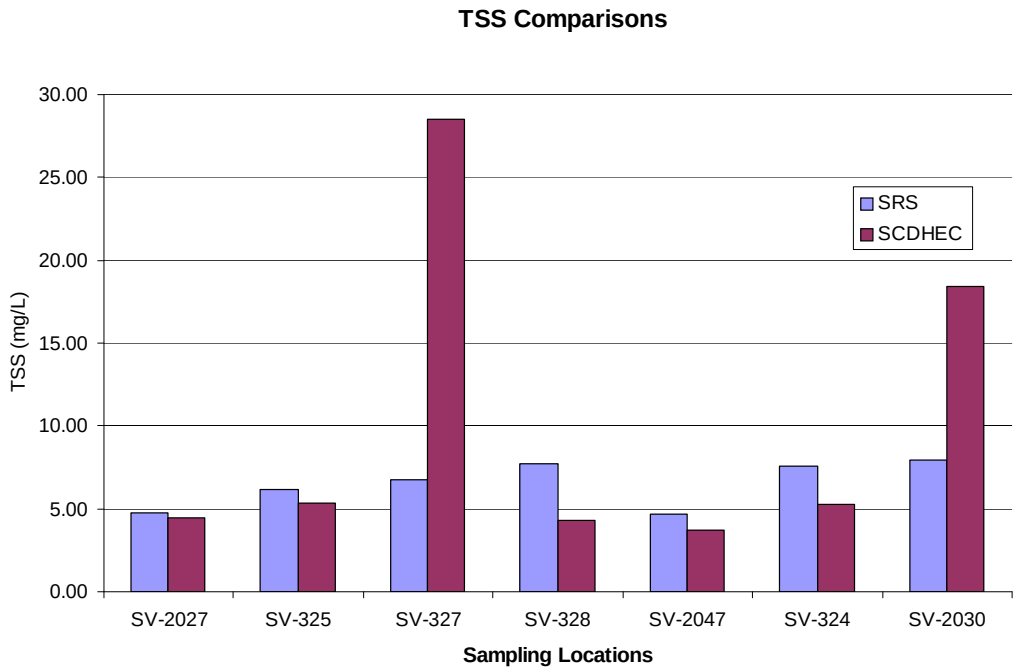


Figure 8



Tables and Figures
Nonradiological Monitoring of Surface Water
Figure 9

Back to Tables and Figures



2.4.4 Data

Nonradiological Monitoring of Surface Water

Data Tables 131

Notes:

1. Empty Cells displayed in tables represent time frames that were unable to be sampled due to adjustments to the project structure in the middle of the year due to access to sampling locations or due to bi-annual sampling criteria.
2. AE = Analytical Error
3. est = estimated amount
4. NTU = Nephelometric Turbidity Units
5. NO_2 = Nitrite
6. NO_3 = Nitrate

Back to List of Data Tables

Nonradiological Monitoring of Surface Water
Nonradiological Surface Water Data

Sample Location:	SV-326							
Sample Date:		units	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07
Monthly Parameters	pH	su	6.42	7.08	6.66	6.32	6.94	6.64
	DO	mg/L	10.54	10.06	9.09	7.76	5.81	4.39
	Water Temperature	celsius	9.8	10.5	13.1	13.3	17.9	25.0
	Alkalinity	mg/L	12.0	15.0	21.0	16.0	29.0	43.0
	Turbidity	NTU	6.6	1.9	3.0	5.7	4.0	5.2
	BOD	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	TSS	mg/L	2.20	<0.50	0.70	2.00	<0.50	5.10
	Fecal Coliform (MFC)	FC/100mL	410	120	55	64	160	100
	NH3 NH4	mg/L	<0.050	AE	0.130	0.180	AE	0.590
	NO3 NO2	mg/L	1.700	12	2.000	1.100	3.700	1.800
	TKN	mg/L	0.91	AE	0.35	0.33	AE	0.76
	Total Phosphorus	mg/L	0.090	0.200	0.160	0.140	0.400	0.310
Quarterly Metals and TOC	Cadmium	mg/L	<0.010					
	Chromium	mg/L	<0.010					
	Copper	mg/L	<0.010					
	Hexavalent Chromium	mg/L	<0.0010					
	Iron	mg/L	0.940					
	Mercury	mg/L	<0.00020					
	Manganese	mg/L	0.088					
	Nickel	mg/L	<0.020					
	Lead	mg/L	<0.050					
	Zinc	mg/L	0.071					
	TOC	mg/L	4.5					
Sample Date:		units	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07
Monthly Parameters	pH	su	6.63	6.60	6.96	7.00	7.26	7.06
	DO	mg/L	4.79	3.43	6.61	6.26	7.32	8.19
	Water Temperature	celsius	23.9	25.1	18.9	14.5	12.9	12.5
	Alkalinity	mg/L	24	27	28	69	33	34
	Turbidity	NTU	10.0	8.3	6.9	2.4	2.4	2.9
	BOD	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	TSS	mg/L	4.5	9.8	10.0	1.6	1.3	1.8
	Fecal Coliform (MFC)	FC/100mL	150	150	200	AE	120	100
	NH3 NH4	mg/L	0.059	0.160	0.075	<0.050	0.053	<0.050
	NO3 NO2	mg/L	0.93	2.1	3.8	1.2	3.1	AE
	TKN	mg/L	0.39	0.55	0.36	AE	0.37	0.40
	Total Phosphorus	mg/L	0.24	0.29	0.52	0.32	0.46	0.028
Quarterly Metals and TOC	Cadmium	mg/L	<0.010					
	Chromium	mg/L	<0.010					
	Copper	mg/L	<0.010					
	Iron	mg/L	1.10					
	Mercury	mg/L	<0.00020					
	Manganese	mg/L	0.081					
	Nickel	mg/L	<0.020					
	Lead	mg/L	<0.050					
	Zinc	mg/L	<0.010					
	TOC	mg/L	6.1					

Nonradiological Monitoring of Surface Water
Nonradiological Surface Water Data

Sample Location:	SV-2027							
Sample Date:		**units**	**Jan-07**	**Feb-07**	**Mar-07**	**Apr-07**	**May-07**	**Jun-07**
Monthly	**pH**	**su**	5.59	6.22	5.83	5.34	6.12	5.88
Parameters	**DO**	**mg/L**	10.51	9.87	10.57	8.62	8.85	7.94
	Water Temperature	**celsius**	11.9	13.1	13.6	14.5	16.2	20.7
	Alkalinity	**mg/L**	1.3	0.7	1.3	1.0	1.0	1.3
	Turbidity	**NTU**	2.1	1.0	1.4	3.6	1.2	2.1
	BOD	**mg/L**	<2.0	<2.0	<2.0	<2.0	<2.0	3.0
	TSS	**mg/L**	0.60	2.40	<0.50	9.00	<0.50	7.20
	Fecal Coliform (MFC)	**FC/100mL**	320	110	200	46	110	46
	NH3 NH4	**mg/L**	<0.050	0.240	0.190	0.180	0.160	0.250
	NO3 NO2	**mg/L**	0.220	0.26	0.230	0.190	0.240	0.230
	TKN	**mg/L**	AE	0.30	0.33	0.19	AE	0.52
	Total Phosphorus	**mg/L**	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Quarterly	**Cadmium**	**mg/L**	<0.010					
Metals	**Chromium**	**mg/L**	<0.010					
and TOC	**Copper**	**mg/L**	<0.010					
	Hexavalent Chromium	**mg/L**	<0.0010					
	Iron	**mg/L**	0.380					
	Mercury	**mg/L**	<0.00020					
	Manganese	**mg/L**	0.012					
	Nickel	**mg/L**	<0.020					
	Lead	**mg/L**	<0.050					
	Zinc	**mg/L**	0.016					
	TOC	**mg/L**	3.4					
Sample Date:		**units**	**Jul-07**	**Aug-07**	**Sep-07**	**Oct-07**	**Nov-07**	**Dec-07**
Monthly	**pH**	**su**	6.00	5.80	5.72	6.51	6.84	6.95
Parameters	**DO**	**mg/L**	7.44	8.30	7.91	7.00	8.46	10.76
	Water Temperature	**celsius**	20.4	21.5	17.6	15.4	15.3	14.4
	Alkalinity	**mg/L**	1.0	<1.0	<1.0	1.0	<1.0	<1.0
	Turbidity	**NTU**	2.4	4.0	3.0	1.4	1.6	1.4
	BOD	**mg/L**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	TSS	**mg/L**	4.2	6.4	4.2	2.5	5.9	2.5
	Fecal Coliform (MFC)	**FC/100mL**	170	220	200	AE	180	480
	NH3 NH4	**mg/L**	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
	NO3 NO2	**mg/L**	0.21	0.21	0.65	0.36	0.22	AE
	TKN	**mg/L**	0.12	0.18	AE	AE	AE	<0.10
	Total Phosphorus	**mg/L**	<0.020	<0.020	<0.020	<0.020	0.034	<0.020
Quarterly	**Cadmium**	**mg/L**	<0.010					
Metals	**Chromium**	**mg/L**	<0.010					
and TOC	**Copper**	**mg/L**	<0.010					
	Iron	**mg/L**	0.22					
	Mercury	**mg/L**	<0.00020					
	Manganese	**mg/L**	<0.010					
	Nickel	**mg/L**	<0.020					
	Lead	**mg/L**	<0.050					
	Zinc	**mg/L**	<0.010					
	TOC	**mg/L**	<2.0					

Nonradiological Monitoring of Surface Water
Nonradiological Surface Water Data

Sample Location:	SV-175							
Sample Date:		units	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07
Monthly Parameters	pH	su	7.25	7.62	7.02	6.83	7.51	7.32
	DO	mg/L	10.93	9.39	9.08	AE	8.57	6.92
	Water Temperature	celsius	13.2	12.3	15.5	14.2	17.4	23.1
	Alkalinity	mg/L	27.0	29.0	38.0	35.0	45.0	46.0
	Turbidity	NTU	3.2	3.9	1.7	2.0	2.0	5.1
	BOD	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	TSS	mg/L	4.00	3.10	0.90	0.80	0.90	4.70
	Fecal Coliform (MFC)	FC/100mL	510	200	410	96	62	100
	NH3 NH4	mg/L	<0.050	0.065	<0.050	AE	AE	AE
	NO3 NO2	mg/L	0.031	0.056	0.032	AE	0.130	0.110
	TKN	mg/L	AE	0.45	0.23	AE	AE	0.32
	Total Phosphorus	mg/L	0.034	0.071	0.033	0.036	0.036	0.041
Quarterly Metals and TOC	Cadmium	mg/L	<0.010					
	Chromium	mg/L	<0.010					
	Copper	mg/L	<0.010					
	Hexavalent Chromium	mg/L	<0.0010					
	Iron	mg/L	0.470					
	Mercury	mg/L	<0.00020					
	Manganese	mg/L	0.026					
	Nickel	mg/L	<0.020					
	Lead	mg/L	<0.050					
	Zinc	mg/L	0.044					
	TOC	mg/L	9.9					
Sample Date:		units	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07
Monthly Parameters	pH	su	7.24	7.35	7.13	7.54	7.50	7.58
	DO	mg/L	7.42	6.58	7.72	7.21	7.69	10.64
	Water Temperature	celsius	23.3	24.9	20.1	14.8	14.6	14.4
	Alkalinity	mg/L	40	50	49	50	45	51
	Turbidity	NTU	9.6	3.6	2.7	1.8	3.2	1.9
	BOD	mg/L	<2.0	<2.0	<2.0	<2.0	2.1	<2.0
	TSS	mg/L	19.0	3.3	3.5	1.1	6.1	1.5
	Fecal Coliform (MFC)	FC/100mL	210	78	180	AE	360	180
	NH3 NH4	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
	NO3 NO2	mg/L	0.12	0.17	0.54	0.094	0.041	AE
	TKN	mg/L	0.33	0.12	0.14	AE	<0.10	<0.10
	Total Phosphorus	mg/L	0.034	0.038	0.030	0.032	0.088	0.027
Quarterly Metals and TOC	Cadmium	mg/L	<0.010					
	Chromium	mg/L	<0.010					
	Copper	mg/L	<0.010					
	Iron	mg/L	0.97					
	Mercury	mg/L	<0.00020					
	Manganese	mg/L	0.120					
	Nickel	mg/L	<0.020					
	Lead	mg/L	<0.050					
	Zinc	mg/L	<0.010					
	TOC	mg/L	6.7					

Nonradiological Monitoring of Surface Water
Nonradiological Surface Water Data

Sample Location:	SV-2047							
Sample Date:		units	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07
Monthly Parameters	pH	su	6.98	7.85	6.89	6.45	7.41	7.30
	DO	mg/L	11.55	9.80	9.53	AE	9.91	7.84
	Water Temperature	celsius	10.3	12.4	14.4	13.2	18.6	23.1
	Alkalinity	mg/L	13.0	13.0	22.0	21.0	23.0	24.0
	Turbidity	NTU	4.4	4.6	3.4	3.9	2.4	3.8
	BOD	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	TSS	mg/L	3.40	14.00	7.40	1.80	1.00	2.80
	Fecal Coliform (MFC)	FC/100mL	160	90	330	64	60	100
	NH3 NH4	mg/L	<0.050	0.130	<0.050	AE	0.610	AE
	NO3 NO2	mg/L	0.120	0.1	0.062	AE	0.110	0.085
	TKN	mg/L	AE	0.36	0.28	AE	AE	0.42
	Total Phosphorus	mg/L	<0.020	<0.020	0.071	0.028	0.025	0.025
Quarterly Metals and TOC	Cadmium	mg/L	<0.010					
	Chromium	mg/L	<0.010					
	Copper	mg/L	<0.010					
	Hexavalent Chromium	mg/L	<0.0010					
	Iron	mg/L	0.600					
	Mercury	mg/L	<0.00020					
	Manganese	mg/L	0.052					
	Nickel	mg/L	<0.020					
	Lead	mg/L	<0.050					
	Zinc	mg/L	0.018					
	TOC	mg/L	7.2					
Sample Date:		units	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07
Monthly Parameters	pH	su	7.51	7.25	7.15	7.79	8.33	7.97
	DO	mg/L	8.21	7.29	8.70	8.52	9.57	11.97
	Water Temperature	celsius	23.4	24.9	19.9	14.8	14.7	13.7
	Alkalinity	mg/L	25	25	23	24	22	22
	Turbidity	NTU	3.2	3.5	2.2	2.4	1.8	2.0
	BOD	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	TSS	mg/L	2.5	3.5	1.9	2.4	1.1	3.0
	Fecal Coliform (MFC)	FC/100mL	200	72	160	AE	35 (est)	55
	NH3 NH4	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
	NO3 NO2	mg/L	0.10	0.17	0.58	0.20	0.12	AE
	TKN	mg/L	0.20	0.12	AE	AE	<0.10	<0.10
	Total Phosphorus	mg/L	0.022	0.028	0.020	0.029	0.078	0.031
Quarterly Metals and TOC	Cadmium	mg/L	<0.010					
	Chromium	mg/L	<0.010					
	Copper	mg/L	<0.010					
	Iron	mg/L	0.41					
	Mercury	mg/L	<0.00020					
	Manganese	mg/L	0.034					
	Nickel	mg/L	<0.020					
	Lead	mg/L	<0.050					
	Zinc	mg/L	<0.010					
	TOC	mg/L	2.8					

Nonradiological Monitoring of Surface Water
Nonradiological Surface Water Data

Sample Location:	SV-327							
Sample Date:		**units**	**Jan-07**	**Feb-07**	**Mar-07**	**Apr-07**	**May-07**	**Jun-07**
Monthly	**pH**	**su**	7.02	7.57	6.85	6.68	7.31	7.17
Parameters	**DO**	**mg/L**	10.89	9.16	9.35	AE	8.98	7.08
	Water Temperature	**celsius**	10.4	12.4	14.2	13.1	18.6	23.3
	Alkalinity	**mg/L**	15.0	15.0	23.0	22.0	24.0	24.0
	Turbidity	**NTU**	2.6	2.8	2.0	2.2	2.4	5.2
	BOD	**mg/L**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	TSS	**mg/L**	0.70	1.00	1.00	300.00	0.80	6.00
	Fecal Coliform (MFC)	**FC/100mL**	210	100	290	62	58	66
	NH3 NH4	**mg/L**	<0.050	0.083	<0.050	AE	AE	AE
	NO3 NO2	**mg/L**	0.045	0.05	0.025	AE	0.067	0.052
	TKN	**mg/L**	AE	0.31	0.17	AE	AE	0.540
	Total Phosphorus	**mg/L**	<0.020	<0.020	0.025	<0.020	<0.020	<0.020
Quarterly	**Cadmium**	**mg/L**	<0.010					
Metals	**Chromium**	**mg/L**	<0.010					
and TOC	**Copper**	**mg/L**	<0.010					
	Hexavalent Chromium	**mg/L**	<0.0010					
	Iron	**mg/L**	0.460					
	Mercury	**mg/L**	<0.00020					
	Manganese	**mg/L**	0.042					
	Nickel	**mg/L**	<0.020					
	Lead	**mg/L**	<0.050					
	Zinc	**mg/L**	0.015					
	TOC	**mg/L**	5.9					
Sample Date:		**units**	**Jul-07**	**Aug-07**	**Sep-07**	**Oct-07**	**Nov-07**	**Dec-07**
Monthly	**pH**	**su**	7.30	7.25	6.99	7.56	7.77	7.38
Parameters	**DO**	**mg/L**	6.54	6.90	7.68	7.33	8.20	10.10
	Water Temperature	**celsius**	23.3	24.6	19.9	14.5	15.3	14.9
	Alkalinity	**mg/L**	21	27	26	27	22	22
	Turbidity	**NTU**	6.4	3.3	2.1	3.6	2.2	2.2
	BOD	**mg/L**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	TSS	**mg/L**	11.0	9.4	2.5	3.5	3.4	2.6
	Fecal Coliform (MFC)	**FC/100mL**	200	110	190	AE	45(est)	33
	NH3 NH4	**mg/L**	<0.050	<0.050	0.051	<0.050	<0.050	<0.050
	NO3 NO2	**mg/L**	0.056	0.093	0.44	0.070	0.03	AE
	TKN	**mg/L**	0.28	0.15	0.39	AE	<0.10	0.25
	Total Phosphorus	**mg/L**	0.020	<0.020	<0.020	0.021	0.050	<0.020
Quarterly	**Cadmium**	**mg/L**	<0.010					
Metals	**Chromium**	**mg/L**	<0.010					
and TOC	**Copper**	**mg/L**	<0.010					
	Iron	**mg/L**	0.68					
	Mercury	**mg/L**	<0.00020					
	Manganese	**mg/L**	0.078					
	Nickel	**mg/L**	<0.020					
	Lead	**mg/L**	<0.050					
	Zinc	**mg/L**	<0.010					
	TOC	**mg/L**	4.6					

Nonradiological Monitoring of Surface Water
Nonradiological Surface Water Data

Sample Location:	SV-325							
Sample Date:		**units**	**Jan-07**	**Feb-07**	**Mar-07**	**Apr-07**	**May-07**	**Jun-07**
Monthly	**pH**	**su**	6.06	7.10	6.33	5.32	7.10	6.48
Parameters	**DO**	**mg/L**	10.67	10.66	9.21	7.73	8.93	7.04
	Water Temperature	**celsius**	10.8	11.7	14.9	14.0	16.9	22.4
	Alkalinity	**mg/L**	2.8	3.2	4.7	1.5	33.0	3.4
	Turbidity	**NTU**	6.2	1.9	2.6	5.2	2.2	6.9
	BOD	**mg/L**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	TSS	**mg/L**	3.00	0.60	1.50	2.60	0.80	10.00
	Fecal Coliform (MFC)	**FC/100mL**	220	92	210	92	140	42
	NH3 NH4	**mg/L**	<0.050	0.650	0.110	AE	AE	AE
	NO3 NO2	**mg/L**	0.130	0.15	0.120	<0.020	0.180	0.120
	TKN	**mg/L**	AE	AE	0.47	AE	AE	0.26
	Total Phosphorus	**mg/L**	<0.020	<0.020	2.700	0.031	0.031	0.029
Quarterly	**Cadmium**	**mg/L**	<0.010					
Metals	**Chromium**	**mg/L**	<0.010					
and TOC	**Copper**	**mg/L**	<0.010					
	Hexavalent Chromium	**mg/L**	<0.0010					
	Iron	**mg/L**	0.640					
	Mercury	**mg/L**	<0.00020					
	Manganese	**mg/L**	0.034					
	Nickel	**mg/L**	<0.020					
	Lead	**mg/L**	<0.050					
	Zinc	**mg/L**	0.072					
	TOC	**mg/L**	4.6					
Sample Date:		**units**	**Jul-07**	**Aug-07**	**Sep-07**	**Oct-07**	**Nov-07**	**Dec-07**
Monthly	**pH**	**su**	6.49	6.75	6.55	8.63	7.02	6.92
Parameters	**DO**	**mg/L**	7.68	7.60	8.26	7.29	9.34	10.76
	Water Temperature	**celsius**	22.2	23.7	20.0	15.3	14.3	14.1
	Alkalinity	**mg/L**	3.7	3.7	2.8	4.0	3.7	3.1
	Turbidity	**NTU**	34.0	4.6	5.2	3.0	2.0	1.9
	BOD	**mg/L**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	TSS	**mg/L**	22.0	5.9	7.7	3.8	2.0	2.2
	Fecal Coliform (MFC)	**FC/100mL**	160	88	200	AE	180	200
	NH3 NH4	**mg/L**	<0.050	<0.050	0.051	<0.050	<0.050	<0.050
	NO3 NO2	**mg/L**	0.14	0.14	0.56	0.15	0.10	AE
	TKN	**mg/L**	AE	0.15	0.25	AE	AE	<0.10
	Total Phosphorus	**mg/L**	0.061	0.049	0.047	0.054	0.087	0.054
Quarterly	**Cadmium**	**mg/L**	<0.010					
Metals	**Chromium**	**mg/L**	<0.010					
and TOC	**Copper**	**mg/L**	<0.010					
	Iron	**mg/L**	1.40					
	Mercury	**mg/L**	<0.00020					
	Manganese	**mg/L**	0.025					
	Nickel	**mg/L**	<0.020					
	Lead	**mg/L**	<0.050					
	Zinc	**mg/L**	<0.010					
	TOC	**mg/L**	2.7					

Nonradiological Monitoring of Surface Water
Nonradiological Surface Water Data

Sample Location:	SV-2030							
Sample Date:		**units**	**Jan-07**	**Feb-07**	**Mar-07**	**Apr-07**	**May-07**	**Jun-07**
Monthly	**pH**	**su**	5.24	4.47	4.81	4.74		
Parameters	**DO**	**mg/L**	9.17	9.48	9.76	8.28		
	Water Temperature	**celsius**	10.6	10.9	11.7	12.6		
	Alkalinity	**mg/L**	<1.0	0.0	<1.0	<1.0		
	Turbidity	**NTU**	1.4	1.0	<1.0	1.4		
	BOD	**mg/L**	<2.0	<2.0	<2.0	<2.0		
	TSS	**mg/L**	<0.50	2.20	<0.50	1.60		
	Fecal Coliform (MFC)	**FC/100mL**	6	250	42	42		
	NH3 NH4	**mg/L**	<0.050	<0.050	0.190	0.170		
	NO3 NO2	**mg/L**	0.027	0.056	<0.020	<0.020		
	TKN	**mg/L**	0.39	0.17	0.19	0.27		
	Total Phosphorus	**mg/L**	0.025	<0.020	0.033	<0.020		
Quarterly	**Cadmium**	**mg/L**	<0.010					
Metals	**Chromium**	**mg/L**	<0.010					
and TOC	**Copper**	**mg/L**	<0.010					
	Hexavalent Chromium	**mg/L**	<0.0010					
	Iron	**mg/L**	0.72					
	Mercury	**mg/L**	<0.00020					
	Manganese	**mg/L**	0.170					
	Nickel	**mg/L**	<0.020					
	Lead	**mg/L**	<0.050					
	Zinc	**mg/L**	0.011					
	TOC	**mg/L**	4.0					
Sample Date:		**units**	**Jul-07**	**Aug-07**	**Sep-07**	**Oct-07**	**Nov-07**	**Dec-07**
Monthly	**pH**	**su**	6.01	5.20	6.14	5.81	6.73	6.70
Parameters	**DO**	**mg/L**	2.95	1.65	3.35	6.80	3.22	6.76
	Water Temperature	**celsius**	25.4	26.9	20.6	18.6	14.0	11.3
	Alkalinity	**mg/L**	7.4	14.0	8.1	6.3	8.2	4.6
	Turbidity	**NTU**	8.5	41	21	12	13	11
	BOD	**mg/L**	2.9	3.6	<2.0	<2.0	2.2	<2.0
	TSS	**mg/L**	15.0	67.0	24.0	9.0	20	8.5
	Fecal Coliform (MFC)	**FC/100mL**	160	180	210	AE	35 (est)	93
	NH3 NH4	**mg/L**	0.14	1.20	0.51	0.43	0.18	0.13
	NO3 NO2	**mg/L**	<0.020	<0.020	0.039	0.032	0.067	AE
	TKN	**mg/L**	0.66	1.80	0.74	AE	0.26	0.52
	Total Phosphorus	**mg/L**	0.027	0.079	0.035	0.024	0.070	0.024
Quarterly	**Cadmium**	**mg/L**	<0.010					
Metals	**Chromium**	**mg/L**	<0.010					
and TOC	**Copper**	**mg/L**	<0.010					
	Iron	**mg/L**	0.22					
	Mercury	**mg/L**	<0.00020					
	Manganese	**mg/L**	<0.010					
	Nickel	**mg/L**	<0.020					
	Lead	**mg/L**	<0.050					
	Zinc	**mg/L**	<0.010					
	TOC	**mg/L**	9.1					

Nonradiological Monitoring of Surface Water
Nonradiological Surface Water Data

Sample Location:	SV-328							
Sample Date:		**units**	**Jan-07**	**Feb-07**	**Mar-07**	**Apr-07**	**May-07**	**Jun-07**
Monthly	**pH**	**su**	7.32	7.57	15.23	6.92	7.48	7.36
Parameters	**DO**	**mg/L**	10.92	9.46	9.07	AE	9.03	7.34
	Water Temperature	**celsius**	10.8	12.0	7.0	14.0	16.9	20.5
	Alkalinity	**mg/L**	31.0	18.0	37.0	37.0	51.0	46.0
	Turbidity	**NTU**	1.7	6.0	1.2	1.4	1.1	3.6
	BOD	**mg/L**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	TSS	**mg/L**	1.10	1.90	1.40	0.50	11.00	6.60
	Fecal Coliform (MFC)	**FC/100mL**	200	220	200	80	56	96
	NH3 NH4	**mg/L**	0.056	0.012	<0.050	AE	AE	AE
	NO3 NO2	**mg/L**	0.039	0.074	0.030	AE	0.120	0.110
	TKN	**mg/L**	AE	0.55	AE	AE	AE	0.21
	Total Phosphorus	**mg/L**	<0.020	0.035	0.035	0.022	0.037	0.028
Quarterly	**Cadmium**	**mg/L**	<0.010					
Metals	**Chromium**	**mg/L**	<0.010					
and TOC	**Copper**	**mg/L**	<0.010					
	Hexavalent Chromium	**mg/L**	<0.0010					
	Iron	**mg/L**	0.270					
	Mercury	**mg/L**	<0.00020					
	Manganese	**mg/L**	0.036					
	Nickel	**mg/L**	<0.020					
	Lead	**mg/L**	<0.050					
	Zinc	**mg/L**	0.013					
	TOC	**mg/L**	6.9					
Sample Date:		**units**	**Jul-07**	**Aug-07**	**Sep-07**	**Oct-07**	**Nov-07**	**Dec-07**
Monthly	**pH**	**su**	7.21	7.50	7.20	8.05	7.51	7.53
Parameters	**DO**	**mg/L**	7.10	7.35	7.82	7.42	7.77	11.30
	Water Temperature	**celsius**	22.0	22.5	18.7	14.6	15.4	15.3
	Alkalinity	**mg/L**	41	51	52	55	49	54
	Turbidity	**NTU**	4.9	3.3	3.2	2.3	2.1	1.1
	BOD	**mg/L**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	TSS	**mg/L**	16	3.8	4.7	1.9	1.4	1.4
	Fecal Coliform (MFC)	**FC/100mL**	200	72	200	AE	120	180
	NH3 NH4	**mg/L**	0.064	<0.050	0.054	0.081	<0.050	<0.050
	NO3 NO2	**mg/L**	<0.020	0.16	0.38	0.14	0.033	AE
	TKN	**mg/L**	0.47	0.15	0.10	AE	<0.10	<0.10
	Total Phosphorus	**mg/L**	0.030	0.035	0.028	0.030	0.026	0.030
Quarterly	**Cadmium**	**mg/L**	<0.010					
Metals	**Chromium**	**mg/L**	<0.010					
and TOC	**Copper**	**mg/L**	<0.010					
	Iron	**mg/L**	0.68					
	Mercury	**mg/L**	<0.00020					
	Manganese	**mg/L**	0.090					
	Nickel	**mg/L**	<0.020					
	Lead	**mg/L**	<0.050					
	Zinc	**mg/L**	<0.010					
	TOC	**mg/L**	9.0					

Nonradiological Monitoring of Surface Water
Nonradiological Surface Water Data

Sample Location:	SV-324							
Sample Date:		**units**	**Jan-07**	**Feb-07**	**Mar-07**	**Apr-07**	**May-07**	**Jun-07**
Monthly	**pH**	**su**	5.74	6.37	6.38	6.18	6.99	6.63
Parameters	**DO**	**mg/L**	10.52	10.63	10.01	8.15	8.82	8.04
	Water Temperature	**celsius**	10.3	11.8	14.4	14.1	16.7	22.7
	Alkalinity	**mg/L**	4.7	4.2	5.6	5.4	5.3	8.4
	Turbidity	**NTU**	3.7	2.5	2.6	3.5	3.8	10.0
	BOD	**mg/L**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	TSS	**mg/L**	1.80	1.70	2.20	2.00	3.30	8.90
	Fecal Coliform (MFC)	**FC/100mL**	190	94	10	68	210	62
	NH3 NH4	**mg/L**	<0.050	AE	0.091	AE	AE	0.260
	NO3 NO2	**mg/L**	0.130	0.14	0.097	0.020	0.110	<0.020
	TKN	**mg/L**	AE	AE	0.22	AE	AE	0.55
	Total Phosphorus	**mg/L**	0.033	0.024	0.050	0.039	0.030	0.047
Quarterly	**Cadmium**	**mg/L**	<0.010					
Metals	**Chromium**	**mg/L**	<0.010					
and TOC	**Copper**	**mg/L**	<0.010					
	Hexavalent Chromium	**mg/L**	<0.0010					
	Iron	**mg/L**	1.000					
	Mercury	**mg/L**	<0.00020					
	Manganese	**mg/L**	0.050					
	Nickel	**mg/L**	<0.020					
	Lead	**mg/L**	<0.050					
	Zinc	**mg/L**	0.019					
	TOC	**mg/L**	3.2					
Sample Date:		**units**	**Jul-07**	**Aug-07**	**Sep-07**	**Oct-07**	**Nov-07**	**Dec-07**
Monthly	**pH**	**su**	6.57	6.30	6.92	7.05	6.91	6.51
Parameters	**DO**	**mg/L**	7.44	8.18	8.27	7.99	9.21	11.42
	Water Temperature	**celsius**	22.8	23.6	19.3	15.3	13.5	12.9
	Alkalinity	**mg/L**	7.1	5.7	6.1	4.8	4.4	3.9
	Turbidity	**NTU**	7.4	9.4	6.0	3.8	3.3	6.0
	BOD	**mg/L**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	TSS	**mg/L**	7.9	12.0	5.6	4.0	5.3	5.2
	Fecal Coliform (MFC)	**FC/100mL**	190	240	210	AE	390	89
	NH3 NH4	**mg/L**	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
	NO3 NO2	**mg/L**	0.03	0.04	0.12	0.06	0.03	AE
	TKN	**mg/L**	0.24	AE	0.14	AE	<0.10	0.12
	Total Phosphorus	**mg/L**	0.043	0.042	0.041	0.065	0.083	0.076
Quarterly	**Cadmium**	**mg/L**	<0.010					
Metals	**Chromium**	**mg/L**	<0.010					
and TOC	**Copper**	**mg/L**	<0.010					
	Iron	**mg/L**	2.50					
	Mercury	**mg/L**	<0.00020					
	Manganese	**mg/L**	0.073					
	Nickel	**mg/L**	<0.020					
	Lead	**mg/L**	<0.050					
	Zinc	**mg/L**	0.012					
	TOC	**mg/L**	<2.0					

Nonradiological Monitoring of Surface Water

Back to List of Data Tables

Nonradiological Surface Water Data

Sample Location:	SV-2045							
Sample Date:		units	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07
Monthly Parameters	pH	su						
	DO	mg/L						
	Water Temperature	celsius						
	Alkalinity	mg/L						
	Turbidity	NTU						
	BOD	mg/L						
	TSS	mg/L						
	Fecal Coliform (MFC)	FC/100mL						
	NH3 NH4	mg/L						
	NO3 NO2	mg/L						
	TKN	mg/L						
	Total Phosphorus	mg/L						
Quarterly Metals and TOC	Cadmium	mg/L						
	Chromium	mg/L						
	Copper	mg/L						
	Hexavalent Chromium	mg/L						
	Iron	mg/L						
	Mercury	mg/L						
	Manganese	mg/L						
	Nickel	mg/L						
	Lead	mg/L						
	Zinc	mg/L						
	TOC	mg/L						
Sample Date:		units	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07
Monthly Parameters	pH	su	6.95	6.75	7.28	7.58	7.47	7.71
	DO	mg/L	5.78	6.03	7.93	6.56	7.07	9.61
	Water Temperature	celsius	23.2	24.9	18.6	14.2	13.1	11.8
	Alkalinity	mg/L	20	23	13	15	17	15
	Turbidity	NTU	5.0	6.3	4.6	3.6	5.0	3.6
	BOD	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	TSS	mg/L	4.0	3.1	3.8	8.4	2.5	2.6
	Fecal Coliform (MFC)	FC/100mL	200	210	190	AE	110	320
	NH3 NH4	mg/L	0.061	<0.050	<0.050	<0.050	<0.050	<0.050
	NO3 NO2	mg/L	0.9	1.0	0.8	1.3	1.5	AE
	TKN	mg/L	AE	0.25	0.14	AE	AE	0.36
	Total Phosphorus	mg/L	0.023	0.022	0.020	0.047	0.053	<0.020
Quarterly Metals and TOC	Cadmium	mg/L	<0.010					
	Chromium	mg/L	<0.010					
	Copper	mg/L	<0.010					
	Iron	mg/L	1.0.					
	Mercury	mg/L	<0.00020					
	Manganese	mg/L	0.062					
	Nickel	mg/L	<0.020					
	Lead	mg/L	<0.050					
	Zinc	mg/L	0.017					
	TOC	mg/L	4.2					

2.4.5 Summary Statistics

Nonradiological Monitoring of Surface Water

Summary Statistics 142

Notes:

1. <LLD = Lower Level of Detection
2. N/A = Not Applicable

Back to List of Statistical Summaries

Nonradiological Monitoring of Surface Water
Summary Statistics

Sample Location: SV-327							
		Avg.	St. Dev.	Median	Max	Min	Num
Monthly Parameters	pH	7.24	0.32	7.28	7.77	6.68	12
	DO	8.38	1.42	8.20	10.89	6.54	11
	Water Temperature	17.0	4.8	15.1	24.6	10.4	12
	Alkalinity	22.3	4.0	22.5	27.0	15.0	12
	Turbidity	3.1	1.4	2.5	6.4	2.0	12
	BOD	N/A	N/A	N/A	0.0	0.0	0
	TSS	28.49	85.57	3.00	300.00	0.70	12
	Fecal Coliform (MFC)	132	85	105	290	33	10
	NH3 NH4	0.067	0.023	0.067	0.083	0.051	2
	NO3 NO2	0.093	0.124	0.054	0.440	0.025	10
	TKN	0.30	0.13	0.28	0.54	0.15	7
	Total Phosphorus	0.029	0.014	0.023	0.050	0.020	4
Quarterly Metals and TOC	Cadmium	N/A	N/A	N/A	0.000	0.000	0
	Chromium	N/A	N/A	N/A	0.000	0.000	0
	Copper	N/A	N/A	N/A	0.000	0.000	0
	Iron	0.57	0.16	0.57	0.68	0.46	2
	Mercury	N/A	N/A	N/A	0.000	0.000	0
	Manganese	0.060	0.025	0.060	0.078	0.042	2
	Nickel	N/A	N/A	N/A	0.000	0.000	0
	Lead	N/A	N/A	N/A	0.000	0.000	0
	Zinc	0.015	N/A	0.015	0.015	0.015	1
	TOC	5.3	0.9	5.3	5.9	4.6	2

Sample Location: SV-324							
		Avg.	St. Dev.	Median	Max	Min	Num
Monthly Parameters	pH	6.62	0.30	6.57	7.05	6.18	11
	DO	8.92	1.26	8.27	11.42	7.44	11
	Water Temperature	17.0	4.3	15.3	23.6	11.8	11
	Alkalinity	5.5	1.3	5.4	8.4	3.9	11
	Turbidity	5.3	2.7	3.8	10.0	2.5	11
	BOD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	TSS	5.28	3.22	5.20	12.00	1.70	11
	Fecal Coliform (MFC)	156	113	142	390	10	10
	NH3 NH4	0.176	0.120	0.176	0.260	0.091	2
	NO3 NO2	0.077	0.047	0.078	0.140	0.020	10
	TKN	0.25	0.17	0.22	0.55	0.12	5
	Total Phosphorus	0.048	0.018	0.043	0.083	0.024	12
Quarterly Metals and TOC	Cadmium	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Chromium	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Copper	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Iron	1.75	1.06	1.75	2.50	1.00	2
	Mercury	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Manganese	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Nickel	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Lead	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Zinc	0.016	0.000	0.016	0.019	0.012	2
	TOC	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD

Nonradiological Monitoring of Surface Water
Summary Statistics

Sample Location:	SV-2027						
		Avg.	St. Dev.	Median	Max	Min	Num
Monthly Parameters	pH	6.07	0.49	5.94	6.95	5.34	12
	DO	8.85	1.28	8.54	10.76	7.00	12
	Water Temperature	16.2	3.2	15.4	21.5	11.9	12
	Alkalinity	1.1	0.2	1.0	1.3	0.7	8
	Turbidity	2.1	1.0	1.9	4.0	1.0	12
	BOD	3.0	0.0	3.0	3.0	3.0	1
	TSS	4.49	2.60	4.20	9.00	0.60	10
	Fecal Coliform (MFC)	189	125	180	480	46	11
	NH3 NH4	0.204	0.039	0.190	0.250	0.160	5
	NO3 NO2	0.275	0.132	0.230	0.650	0.190	11
	TKN	0.27	0.14	0.25	0.52	0.12	6
	Total Phosphorus	0.034	N/A	0.034	0.034	0.034	1
Quarterly Metals and TOC	Cadmium	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Chromium	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Copper	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Iron	0.30	0.11	0.30	0.38	0.22	2
	Mercury	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Manganese	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Nickel	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Lead	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Zinc	0.016	0.000	0.016	0.016	0.016	1
	TOC	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD

Sample Location:	SV-2047						
		Avg.	St. Dev.	Median	Max	Min	Num
Monthly Parameters	pH	7.41	0.52	7.36	8.33	6.45	12.00
	DO	9.35	1.46	9.53	11.97	7.29	11.00
	Water Temperature	17.0	4.9	14.7	24.9	10.3	12.0
	Alkalinity	21.4	4.1	22.5	25.0	13.0	12.0
	Turbidity	3.1	1.0	3.3	4.6	1.8	12.0
	BOD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	TSS	3.73	3.63	2.65	14.00	1.00	12.00
	Fecal Coliform (MFC)	129	87	95	330	55	10
	NH3 NH4	0.370	0.339	0.370	0.610	0.130	2.000
	NO3 NO2	0.165	0.151	0.115	0.580	0.062	10.000
	TKN	0.28	0.12	0.28	0.42	0.12	5.00
	Total Phosphorus	0.036	0.021	0.028	0.078	0.020	10.000
Quarterly Metals and TOC	Cadmium	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Chromium	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Copper	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Iron	0.51	0.13	0.51	0.60	0.41	2.00
	Mercury	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Manganese	0.043	0.013	0.043	0.052	0.034	2.000
	Nickel	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Lead	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Zinc	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	TOC	5.0	3.1	5.0	7.2	2.8	2.0

Nonradiological Monitoring of Surface Water
Summary Statistics

Sample Location: SV-325							
		Avg.	St. Dev.	Median	Max	Min	Num
Monthly Parameters	pH	6.79	0.79	6.75	8.63	5.32	11
	DO	8.59	1.30	8.26	10.76	7.04	11
	Water Temperature	17.2	4.1	15.3	23.7	11.7	11
	Alkalinity	6.1	9.0	3.7	33.0	1.5	11
	Turbidity	6.3	9.3	3.0	34.0	1.9	11
	BOD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	TSS	5.37	6.28	2.60	22.00	0.60	11
	Fecal Coliform (MFC)	140	59	150	210	42	10
	NH3 NH4	0.270	0.330	0.110	0.650	0.051	3
	NO3 NO2	0.179	0.136	0.140	0.560	0.100	10
	TKN	0.28	0.13	0.26	0.47	0.15	4
	Total Phosphorus	0.314	0.838	0.052	2.700	0.029	10
Quarterly Metals and TOC	Cadmium	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Chromium	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Copper	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Iron	1.02	0.54	1.02	1.40	0.64	2
	Mercury	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Manganese	0.0295	0.006364	0.0295	0.034	0.025	2
	Nickel	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Lead	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Zinc	0.072	N/A	0.072	0.072	0.072	1
	TOC	3.7	1.3	3.7	4.6	2.7	2

Sample Location: SV-175							
		Avg.	St. Dev.	Median	Max	Min	Num
Monthly Parameters	pH	7.32	0.24	7.34	7.62	6.83	12
	DO	8.38	1.47	7.72	10.93	6.58	11
	Water Temperature	17.3	4.4	15.2	24.9	12.3	12
	Alkalinity	42.1	8.3	45.0	51.0	27.0	12
	Turbidity	3.4	2.2	3.0	9.6	1.7	12
	BOD	2.1	N/A	2.1	2.1	2.1	1
	TSS	4.08	5.00	3.20	19.00	0.80	12
	Fecal Coliform (MFC)	217	148	180	510	62	11
	NH3 NH4	0.065	N/A	0.065	0.065	0.065	1
	NO3 NO2	0.132	0.151	0.102	0.540	0.031	10
	TKN	0.27	0.13	0.28	0.45	0.12	6
	Total Phosphorus	0.042	0.018	0.035	0.088	0.027	12
Quarterly Metals and TOC	Cadmium	N/A	N/A	N/A	0.000	0.000	0
	Chromium	N/A	N/A	N/A	0.000	0.000	0
	Copper	N/A	N/A	N/A	0.000	0.000	0
	Iron	0.72	0.35	0.72	0.97	0.47	2
	Mercury	N/A	N/A	N/A	0.000	0.000	0
	Manganese	0.073	0.066	0.073	0.120	0.026	2
	Nickel	N/A	N/A	N/A	0.000	0.000	0
	Lead	N/A	N/A	N/A	0.000	0.000	0
	Zinc	0.044	N/A	0.044	0.044	0.044	1
	TOC	8.3	2.3	8.3	9.9	6.7	2

Nonradiological Monitoring of Surface Water
Summary Statistics

Sample Location: SV-328							
		Avg.	St. Dev.	Median	Max	Min	Num
Monthly Parameters	pH	8.07	2.27	7.49	15.23	6.92	12.00
	DO	8.60	1.48	7.82	11.30	7.10	11.00
	Water Temperature	15.8	4.6	15.4	22.5	7.0	12.0
	Alkalinity	43.5	11.1	47.5	55.0	18.0	12.0
	Turbidity	2.7	1.6	2.2	6.0	1.1	12.0
	BOD	N/A	N/A	N/A	0.0	0.0	0.0
	TSS	4.31	4.76	1.90	16.00	0.50	12.00
	Fecal Coliform (MFC)	148	63	180	220	56	11
	NH3 NH4	0.053	0.025	0.056	0.081	0.012	5.000
	NO3 NO2	0.121	0.108	0.110	0.380	0.030	9.000
	TKN	0.30	0.20	0.21	0.55	0.10	5.00
	Total Phosphorus	0.031	0.005	0.030	0.037	0.022	11.000
Quarterly Metals and TOC	Cadmium	N/A	N/A	N/A	0.000	0.000	0.000
	Chromium	N/A	N/A	N/A	0.000	0.000	0.000
	Copper	N/A	N/A	N/A	0.000	0.000	0.000
	Iron	0.48	0.29	0.48	0.68	0.27	2.00
	Mercury	N/A	N/A	N/A	0.000	0.000	0.000
	Manganese	0.063	0.038	0.063	0.090	0.036	2.000
	Nickel	N/A	N/A	N/A	0.000	0.000	0.000
	Lead	N/A	N/A	N/A	0.000	0.000	0.000
	Zinc	0.013	N/A	0.013	0.013	0.013	1.000
	TOC	8.0	1.5	8.0	9.0	6.9	2.0

Sample Location: SV-2030							
		Avg.	St. Dev.	Median	Max	Min	Num
Monthly Parameters	pH	5.59	0.81	5.53	6.73	4.47	10.00
	DO	6.14	3.08	6.78	9.76	1.65	10.00
	Water Temperature	16.2	6.2	13.3	26.9	10.6	10.0
	Alkalinity	6.9	4.2	7.4	14.0	0.0	7.0
	Turbidity	12.3	12.7	11.0	41.0	1.0	9.0
	BOD	2.9	0.7	2.9	3.6	2.2	3.0
	TSS	18.41	21.17	12.00	67.00	1.60	8.00
	Fecal Coliform (MFC)	123	89	127	250	6	8
	NH3 NH4	0.369	0.365	0.185	1.200	0.130	8.000
	NO3 NO2	0.044	0.017	0.039	0.067	0.027	5.000
	TKN	0.56	0.51	0.39	1.80	0.17	9.00
	Total Phosphorus	0.040	0.022	0.030	0.079	0.024	8.000
Quarterly Metals and TOC	Cadmium	N/A	N/A	N/A	0.000	0.000	0.000
	Chromium	N/A	N/A	N/A	0.000	0.000	0.000
	Copper	N/A	N/A	N/A	0.000	0.000	0.000
	Iron	0.47	0.35	0.47	0.72	0.22	2.00
	Mercury	N/A	N/A	N/A	0.000	0.000	0.000
	Manganese	0.170	N/A	0.170	0.170	0.170	1.000
	Nickel	N/A	N/A	N/A	0.000	0.000	0.000
	Lead	N/A	N/A	N/A	0.000	0.000	0.000
	Zinc	0.011	N/A	0.011	0.011	0.011	1.000
	TOC	6.6	3.6	6.6	9.1	4.0	2.0

Nonradiological Monitoring of Surface Water
Summary Statistics

Back to List of Statistical Summaries

Sample Location: SV-2045							
		Avg.	St. Dev.	Median	Max	Min	Num
Monthly Parameters	pH	7.29	0.37	7.38	7.71	6.75	6.00
	DO	7.16	1.42	6.82	9.61	5.78	6.00
	Water Temperature	17.6	5.5	16.4	24.9	11.8	6.0
	Alkalinity	17.2	3.7	16.0	23.0	13.0	6.0
	Turbidity	4.7	1.0	4.8	6.3	3.6	6.0
	BOD	N/A	N/A	N/A	0.0	0.0	0.0
	TSS	4.07	2.21	3.45	8.40	2.50	6.00
	Fecal Coliform (MFC)	206	75	200	320	110	5
	NH3 NH4	0.061	N/A	0.061	0.061	0.061	1.000
	NO3 NO2	1.086	0.308	1.000	1.500	0.750	5.000
	TKN	0.25	0.11	0.25	0.36	0.14	3.00
	Total Phosphorus	0.033	0.016	0.023	0.053	0.020	5.000
Quarterly Metals and TOC	Cadmium	N/A	N/A	N/A	0.000	0.000	0.000
	Chromium	N/A	N/A	N/A	0.000	0.000	0.000
	Copper	N/A	N/A	N/A	0.000	0.000	0.000
	Iron	N/A	N/A	N/A	0.00	0.00	0.00
	Mercury	N/A	N/A	N/A	0.000	0.000	0.000
	Manganese	0.062	N/A	0.062	0.062	0.062	1.000
	Nickel	N/A	N/A	N/A	0.000	0.000	0.000
	Lead	N/A	N/A	N/A	0.000	0.000	0.000
	Zinc	0.017	N/A	0.017	0.017	0.017	1.000
	TOC	4.2	N/A	4.2	4.2	4.2	1.0

Sample Location: SV-326							
		Avg.	St. Dev.	Median	Max	Min	Num
Monthly Parameters	pH	6.83	0.28	6.94	7.26	6.32	11
	DO	6.70	2.03	6.61	10.06	3.43	11
	Water Temperature	17.1	5.4	14.5	25.1	10.5	11
	Alkalinity	30.8	15.0	28.0	69.0	15.0	11
	Turbidity	4.8	2.7	4.0	10.0	1.9	11
	BOD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	TSS	4.09	3.60	2.00	10.00	0.70	9
	Fecal Coliform (MFC)	122	45	120	200	55	10
	NH3 NH4	0.178	0.188	0.130	0.590	0.053	7
	NO3 NO2	3.039	3.134	2.000	12.000	0.930	11
	TKN	0.49	0.21	0.39	0.91	0.33	9
	Total Phosphorus	0.263	0.149	0.265	0.520	0.028	12
Quarterly Metals and TOC	Cadmium	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Chromium	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Copper	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Iron	1.02	0.11	1.02	1.10	0.94	2
	Mercury	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Manganese	0.085	0.005	0.085	0.088	0.081	2
	Nickel	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Lead	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
	Zinc	0.071	N/A	0.071	0.071	0.071	1
	TOC	5.3	1.1	5.3	6.1	4.5	2

2.5 Radiological and Nonradiological Monitoring of Sediments

2.5.1 Summary

Sediment contamination can have direct impacts on aquatic life. Point source and nonpoint source pollutants impact water bodies through direct discharge, atmospheric fallout, or through runoff. These contaminants may then mobilize in streams and rivers consequently dispersing contaminants downstream. The high mobility of sediments is a complicating issue as stream flow changes can redistribute contaminants or bury them as part of the natural sedimentation process. Patterns of sediment contamination are strongly affected by hydrologic factors and the physical and chemical characterization of the sediment (USEPA 1987). Sediment may also affect the bioavailability of the contaminants as particles may bind to the sediment thus immobilizing the pollutant. Aquatic organisms can consume the contaminants and enable uptake in the food chain.

The Department of Energy's Savannah River Site (DOE-SR) streams receive surface water runoff and water from permitted discharges (USDOE 1995). Storm water basins may receive not only runoff, but also atmospheric fallout from diffuse and fugitive sources. Cesium-137 (Cs-137) contamination occurs along the entire length of Lower Three Runs Creek (LTRC) and Steel Creek on the Savannah River Site (SRS), and the private property of Creek Plantation due to accidental releases of nuclear materials from past operations. LTRC and Steel Creek watersheds are under investigation because it represents a possible pathway for release of contamination from SRS activities, to both on-site and off-site receptors and the environment (WSRC 2002b). Flooding and dam releases from Par Pond and L-Lake, due to yearly maintenance, scour creek bottoms which could cause movement of contaminated sediments. The Environmental Surveillance Oversight Program (ESOP) as part of the South Carolina Department of Health and Environmental Control (SCDHEC) evaluated sediment for radionuclide concentrations in 13 SRS streams (Section 2.5.2, Map 7) and seven stormwater basins. The stream samples were also analyzed for organic and inorganic constituents. Sediment samples on SRS were split with DOE-SR. SRS stream sampling locations are listed in Section 2.5.3, Table 1. The ESOP ambient sediment monitoring project changed in 2007 to include more random coverage of perimeter sediments (those within 50 miles of SRS) and background sediments (those greater than 50 miles). This sampling program was implemented to allow future probabilistic comparisons of the SRS perimeter and South Carolina background contaminant levels in sediment. The United States Geological Survey (USGS) 7.5' Quadrangle Coverage for South Carolina (USDOI 1992) was used to determine the ESOP random quadrant sampling areas. ESOP sampled 27 perimeter sediments and 11 background sediments for gross alpha, gross non-volatile beta, gamma, and inorganic metals. Refer to Section 2.5.3, Tables 2-3 and Map 1 for random sampling locations. Assessment of radiological, inorganic and organic contaminants in sediment is necessary to detect any impact from DOE-SR operations beyond historically impacted areas.

Gross alpha-emitting radionuclides were not detected among the samples from SRS. However, there were single detections among the random perimeter samples and the background samples. Gross non-volatile beta was detected among 75% of SRS samples and in four perimeter and six background samples. The samples collected from SRS streams and creek mouths were only slightly higher on average than those collected offsite in both perimeter and background locations. The stormwater basins also yielded gross beta detections, but at a slightly lower average than other samples. Refer to Section 2.5.3, Figure 9.

Gamma spectroscopy led to detections of anthropogenic radionuclides. On average, Cs-137 levels were highest in samples collected from SRS streams, followed by SRS basins. Although lower than those collected on SRS, the background samples were on average higher than those within 50 miles of the SRS perimeter. Americium-241 (Am-241) was only detected in one background sample. Technetium-99 (Tc-99) was present in many of the SRS stream sediment samples analyzed. Inorganic metals were found not only on SRS, but also throughout the state. All metals analyzed were below the United States Environmental Protection Agency (USEPA) Preliminary Remediation Goals (PRG). Also, there were some organic contaminant detections at very low levels in the SRS stream sediments. Data comparison of 2007 sediment data from ESOP and DOE-SR split samples resulted in similar findings. Both split sample data sets report that the highest Cs-137 levels are found in Fourmile Branch creek mouth. The samples from the creek mouths are higher than those collected at the various upstream locations. ESOP Cs-137 data from the SRS creek mouths have been trended for 2003-2007. Although down from 2003 levels, average Cs-137 levels increased from 2006 to 2007. Due to the nature of sediments, variability in sediment samples can be anticipated. A complete list of analytes can be found in Section 2.5.3, Tables 4-6. In addition to collecting sediment for analysis, ESOP initiated a study in 2007 to compare yearly in-situ Cs-137 radiation results using a portable Sodium Iodide (NaI) detector.

The SRS stream sediments from Upper Three Runs and McQueen Branch had the highest levels of several heavy metals. Cesium-137 and Tc-99 were prevalent radionuclides found in many of the sediment samples. The continuation of sediment sampling and analysis, along with trending of data, is necessary to closely monitor SRS sediments. The potential for contaminants to impact not only the environment of SRS but the publicly accessible Savannah River through immobilization warrants these monitoring efforts.

RESULTS AND DISCUSSION

Radiological Parameter Results

Radioisotopes were not only detected in samples collected on SRS, but in background samples as well. The USEPA PRG is used as a screening tool that corresponds to certain levels of human risk in soil (USEPA 2004). Since the USEPA does not have PRGs in place for sediment, soil PRGs are used to make a general comparison.

Gross alpha-emitting radionuclides were released to the air at SRS primarily from M-area, the reactor areas and the separations facilities (CDC 2006). Although gross alpha was detected in four of the 14 sediment samples collected in 2006, there were no detections in the 2007 samples from SRS streams and storm water basins. However, four random perimeter samples as well as one background sample detected gross alpha emitting particles. The random perimeter samples averaged 20.0 (± 3.2) picocuries per gram (pCi/g) and ranged from 15.9 to 23.5 pCi/g. The highest detection was in sediment collected in quadrant E1 in Hampton County, South Carolina. The random background sample that had a detection of 22.3 pCi/g was collected from quadrant B9 in Berkeley County, South Carolina.

Gross beta-emitting radionuclides were released from the separations areas on the SRS (CDC 2006). Gross non-volatile beta was detected in 10 SRS stream samples at an average of 18.71 (± 6.06) pCi/g and ranged from 12.01 to 28.8 pCi/g. The highest detection was located at SMSV-2048 (Pen Branch at SC 125). Five of the seven storm water basins sampled had detections averaging 12.52 (± 3.91) pCi/g and ranged from 7.59 to 15.8 pCi/g. Basin E-001 had the highest detection. Four random perimeter samples as well as six background samples detected gross beta-emitting particles. The random perimeter samples averaged 17.5 (± 4.7) pCi/g, ranging from 12.3 to 23.7 pCi/g. The highest detection was in sediment collected in quadrant E21 in Bamberg County, South Carolina. The random background samples had detections averaging 17.7 (± 13.5) pCi/g, ranging from 6.86 to 44.1 pCi/g. The highest detection in sediments collected in 2007 was from a sample collected in quadrant B7 in Greenville County, South Carolina.

Technetium-99 (Tc-99) was produced in SRS production reactors as a fission byproduct of uranium and plutonium. Technetium-99 was released to the environment from the separation areas ventilation systems, the aqueous environment from liquid waste in waste tanks, and the Solid Waste Disposal Facility (WSRC 1993). Technetium-99 was analyzed in SRS stream sediments only. Nine sediment samples detected Tc-99 at an average of 0.345 (± 0.072) pCi/g and ranged from 0.255 to 0.465 pCi/g. The highest detection was located at SMSV-2069 (McQueen Branch). Technetium-99 is part of a suite of radionuclides expected to come almost exclusively from SRS releases (Till et al. 2001). A conservative USEPA PRG corresponding to a one in a million (1E-06) increased cancer risk is 96.3 pCi/g for a residential soil scenario (USEPA 2004).

Cesium-137 is an artificially produced fission product. Atmospheric Cs-137 was released from the separation areas and was a key radionuclide released to water and air, mainly from F and H areas (CDC 2006). The liquid releases were also from the reactors as a result of leaking fuel elements in the 1950s and 60s (WSRC 1998). Cesium was detected in nine SRS stream samples at an average of 0.6590 (± 0.6702) pCi/g and ranged from 0.0797 to 2.267 pCi/g. The highest detection was located at SMSV-2015 (Fourmile Branch at RM 150.6). Four of the seven storm water basins sampled had detections averaging 0.4397 (± 0.6200) pCi/g and ranged from 0.0947 to 1.369 pCi/g. Z Basin had the highest detection. A conservative USEPA PRG corresponding to a 1E-06 increased cancer risk is 23.4 pCi/g for a residential soil scenario (USEPA 2004). Eight random perimeter samples as well as two background samples detected Cs-137. The random perimeter samples averaged 0.1052 (± 0.0932) pCi/g and ranged from 0.0217 to 0.2794 pCi/g. The highest detection was in sediment collected in quadrant E1 in Hampton County. The random background samples had detections averaging 0.277 (± 0.346) pCi/g and ranged from 0.0319 to 0.52121 pCi/g. The highest detection in background sediments collected in 2007 was from a sample collected in quadrant B9 in Berkeley County.

Only one sediment sample collected in 2007 had a detection for Am-241. Sediment from quadrant B6 in Abbeville County, South Carolina detected Am-241 at 0.2469 pCi/g. Americium-241 is a man-made transuranic nuclide produced during the fission process. Long-lived in the environment with a half-life of 432 years, this nuclide may be a legacy of past nuclear fallout events. However, previous studies indicate that Am-241 was released in significant quantities from the SRS (Till et al. 2001). Along with Cs-137, Am-241 was released to the air from SRS

(CDC 2006). A conservative USEPA PRG corresponding to a 1E-06 increased cancer risk is 1.97 pCi/g for a residential soil scenario (USEPA 2004).

Results for europium-155 and manganese-54 could not be reported due to interference from the naturally occurring actinium-228 in the gamma spectroscopy. These radiological false positives occur because a naturally occurring nuclide, or combination of nuclides, may cause gamma instrument software to report a false positive of a reactor product (WSRC 2003b). There were detections of actinium-228, potassium-40, lead-212, lead-214, radium-226 and thorium-234. These are Naturally Occurring Radioactive Material (NORM) decay products that may account for these detections. All other gamma-emitting radionuclides had no detections above their respective Minimum Detectable Activity (MDA).

Although historical fallout from weapons testing has been the most important man-made contributor to radioactive contamination of the global environment, there are other anthropogenic sources such as SRS operations. Also, some radionuclides occur naturally in the environment (Till et al. 2001). Separating radioactivity contributed by releases from the SRS from weapons fallout is difficult for some radioisotopes (Till et al. 2001).

ESOP 2007 radiological data can be found in Section 2.5.4 and statistical data can be found in Section 2.5.5. Figures 2-4 in Section 2.5.3 illustrate gamma results.

Cesium-137 Data Trending

ESOP and DOE-SR have shared split-samples and data since 2006. Until more split sample data can be collected, we will only trend ESOP Cs-137 data for the SRS creek mouth sediments that are sampled annually. The data from 2003-2007 shows, that on average, the five creek mouths declined in Cs-137 levels. The creek mouths of Beaver Dam Creek and Steel Creek showed an overall decline in Cs-137 levels, while Fourmile Branch, Upper Three Runs and Lower Three Runs showed an overall increase. Trending data for Cs-137 in Savannah River sediment samples is in Figures 1, Section 2.5.3.

Nonradiological Parameter Results

Inorganic metals were detected in many of the sediment samples. The South Carolina state averages are from the Summary of Selected Water Quality Parameter Concentrations in South Carolina Water and Sediments (SCDHEC 1998b). The Ecological Screening Value (ESV) for sediment does not represent remediation goals or cleanup levels but are used to identify constituents of potential concern (WSRC 2005b).

Chromium solutions were used at the SRS as corrosive inhibitors. Chromium was a part of wastewater solutions resulting from dissolving stainless steel. It was also used in cleaning solutions in the separation areas (Till et al. 2001). Chromium was detected in all 13 SRS stream sediment samples and was above the South Carolina state average of 13.39 milligrams per kilogram (mg/kg) in two sample locations. Upper Three Runs at Rd. C (SMSV-2073) and Pen Branch at Hwy. 125 (SMSV-2048) each had a detection of 23 mg/kg. Detections averaged 9.5 (± 7.4) mg/kg, and ranged from 1.2 to 23 mg/kg. The ESV for sediment is 36 mg/kg. The

random perimeter sediment samples averaged 7.92 (± 12.24) mg/kg, while the random background sediment samples averaged 11.75 (± 11.57) mg/kg.

Copper, while naturally occurring, can also be released to the environment through the combustion of wood, coal and oil (Alloway 1995). These mechanisms are possible sources of elevated copper in the sediments. Copper was detected at 10 SRS stream locations at an average of 12.2 (± 20.1) mg/kg and ranged from 2 to 69 mg/kg. As for chromium, SMSV-2073 and SMSV-2048 were above the state average of 9.13 mg/kg. Detections were 69mg/kg at SMSV 2073 and 9.2 mg/kg for SMSV 2048. For comparison, except for SMSV-2073, all other sites were below the ESV of 18.7. The random perimeter sediment samples averaged 7.58 (± 7.90) mg/kg while the random background sediment samples averaged 5.48 (± 3.38) mg/kg.

Nickel was released through M-area effluent from the plating rinse tanks (Till et al. 2001). This metal was detected above the state average of 3.92 mg/kg in eight sample locations. Detections below the state average occurred at two additional locations. Detections averaged 6.1 (± 4.0) mg/kg, and ranged from 2.4 to 17.0 mg/kg. SMSV-2073, the only site that exceeded the ESV of 15.9 mg/kg, had the highest levels of 17 mg/kg. The random perimeter sediment samples averaged 6.66 (± 3.47) mg/kg while the random background sediment samples averaged 5.72 (± 2.27) mg/kg.

Atmospheric emissions of lead from SRS occurred through coal and fuel combustion (Till et al. 2001). Lead can deposit in sediments where it has a long residence time when compared to other pollutants (Alloway 1995). Lead was detected at nine locations with an average of 15.0 (± 7.6) mg/kg and was above the state average of 16.32 mg/kg at two locations. Detections ranged from 6.6 to 29 mg/kg. SMSV-2073 and SMSV-2048 had the highest levels of lead at 26 and 29 mg/kg respectively. All samples were below the ESV of 30.2 mg/kg. The random perimeter sediment samples averaged 15.98 (± 21.53) mg/kg while the random background sediment samples averaged 13.05 (± 7.37) mg/kg.

Zinc was released in relatively small amounts to the separations area seepage basins as well as the M-area seepage basin (Till et al. 2001). Zinc was detected in eight samples above the state average of 21.61 mg/kg and occurred in four additional samples below the state average. Detections averaged 37.0 (± 31.7) mg/kg, and ranged from 3.7 to 100.0 mg/kg. Three of the sediment samples were notably higher than the state average. SMSV-2069, SMSV-2073 and SMSV-2048 had detections of 100, 93, and 59 mg/kg, respectively. For comparison, all but SMSV-2069 were below the ESV of 98 mg/kg. The random perimeter sediment samples averaged 11.55 (± 13.44) mg/kg while the random background sediment samples averaged 14.07 (± 12.18) mg/kg.

Additional inorganic metals were detected in SRS stream sediments. Aluminum, cobalt, iron, and manganese were all higher than the South Carolina average for coastal plain sediments (Canova 1999). However, the random perimeter and background samples also were higher than the South Carolina average. Magnesium was higher than the state average for the SRS stream sediments and the random background samples. The random perimeter samples were lower than the coastal plain average. The random samples yielded additional metal detections. A statistical summary can be found in Section 2.5.3, Table 9.

There were some organic contaminant detections at very low levels. One sample, SMSV-2011, showed a detection of the phenolic compound 4-methylphenol. This contaminate is associated with wood waste (Norton, Stinson, and Yake 1987). Polycyclic Aromatic Hydrocarbons (PAHs) are associated with the combustion of petroleum and fossil fuel (Johnson 2000). SMSV-325 had detections for the PAHs benzo(a)pyrene, benzo(ghi)perylene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene. SMSV-325 and SMSV-2048 also detected the semi- volatile organic compound di-n-octylphthalate. All other base neutral/acid extractable organics (BNA) and pesticide analytes were below detection limits. The complete list of BNA analytes are found in Section 2.5.3, Table 6.

Note that sediment from SMSV-2073 had the highest stream sediment concentrations for chromium, copper, nickel and the second highest for zinc. Cu and Ni were above not only the state averages, but were above the ESV as well. SMSV-2069 (McQueen Branch) had the highest concentration of Zinc. This detection was above the ESV. The Pen Branch sediment sampling location near Highway 125 (SMSV-2048) yielded concentrations higher than the state average for many metals, but they were all below the ESV.

ESOP 2007 nonradiological statistical data can be found in Section 2.5.5 and ESOP nonradiological sediment data can be found in Section 2.5.4.

Sodium Iodide (NaI) Detector Results

Three sampling transects were constructed by hammering permanent steel rebar into sediment at each location. Two of the transects were constructed on the LTRC floodplain of SRS. The first LTRC transect (LTRC 1) was constructed just north of Patterson Mill Road and the second transect (LTRC 2) was constructed approximately one mile from the Savannah River. One transect was constructed on the Steel Creek flood plain of Creek Plantation, a privately owned land area on the southeastern border of the DOE-SR, approximately 100 meters from the Steel Creek boat ramp public access point. Transects were extended across the highest areas of Cs-137 from values observed in contoured aerial gamma surveys conducted in 1991 and 1998. The two LTRC transects consist of 10 sampling/monitoring locations spaced approximately 20 meters apart across areas of higher Cs-137 activity to background areas bisecting the floodplain. The Steel Creek transect consists of 11 sample locations spaced approximately 30 meters apart from the areas of higher Cs-137 activity to background areas. Field measurements were taken using a two inch by two inch NaI detector. The detector was placed 30 centimeters above the ground surface on a due east heading approximately 25 centimeters from each permanent marker. Calibration of the NaI detector was verified daily using a Cs-137 check source. Two spectra were recorded at each sampling location to determine the ground surface activity. First, the general area radiation spectrum was obtained by counting with an unshielded detector for 180 seconds. The second spectrum was taken with a five centimeter lead brick placed beneath the detector for an additional 180 seconds so that surrounding background activity could be subtracted out from ground shine. The net count rate in the Cs-137 gamma ray peak was determined at each location. (Section 2.5.3, Table 10) The net peak intensity in the soil directly under the detector (6 inch radius) was determined by subtracting the shielded count rate from the unshielded count rate at each location.

In 2007, ESOP also collected additional spectra recording one meter away from permanent markers along with collecting sediment samples from the LTRC transects for an analytical comparison to in-situ reading. Sediment collections were made a meter away so that sediment at the permanent monitoring location was not disturbed so future measurements would not be compromised. Sediment samples were dried, weighed, and stored at the EQC office until sent to the SCDHEC Radiological Environmental Monitoring Division, Columbia, South Carolina for analysis of gamma-emitting radioisotopes using a high purity germanium detector.
Evaluation of NaI field measurement compared to the standard laboratory analyses of Cs-137 indicated that the NaI field method provides a good indicator of areas of Cs-137 contamination (Section 2.5.3, Figures 12 - 13).

ESOP and DOE-SR Data Comparison

DOE-SR and ESOP split 13 SRS stream sediment and 7 stormwater basin sediment samples in March 2007. Cesium-137, Co-60, and Am-241 were the only nonNORM gamma-emitting radionuclides where ESOP and DOE-SR shared analysis results (WSRC 2008a). Since there were no detections above the MDA for Co-60 in either dataset and only DOE-SR detected Am-241, only Cs-137 will be compared in this report. DOE-SR did not analyze for gross alpha- or gross beta-emitting particles. The highest detected Cs-137 concentration detected by both agencies was at the Fourmile Branch creek mouth. DOE-SR detected 2.21 (± 0.0938) pCi/g while ESOP detected 2.267 (± 0.1691) pCi/g. When averaging all the SRS stream sediment samples, ESOP found 0.659 (± 0.769) pCi/g Cs-137 while DOE-SR found 0.618 (± 0.754) pCi/g. The average of Cs-137 in the stormwater basins was found to be 0.440 (± 0.620) pCi/g compared to 0.519 (± 0.647) pCi/g as found by DOE-SR. Analytical results of Cs-137 in stream sediments and stormwater basin sediments are within one standard deviation. Figures 5-6 in Section 2.5.3 illustrate the findings.

Americium-241 was detected by DOE-SR at an average of 0.013 (± 0.019) pCi/g in stream sediments and 0.009 (± 0.006) pCi/g in the stormwater basin sediments. The average MDA for the 2007 ESOP sediment samples was 0.1428 pCi/g, which is much higher than the DOE-SR Minimum Detectable Concentration (MDC) of 0.0039 pCi/g. Since DOE-SR has a much lower MDC, this may explain why the ESOP data does not report detections above the MDA.

A nonradiological comparison of DOE-SR and ESOP data show that both data sets agree that chromium, copper and lead were below the ESV. Both also report that zinc was above the ESV in SMSV-2069 (McQueen Branch). Results vary for nickel where ESOP found it higher than the ESV in SMSV-2073 while DOE-SR did not. DOE-SR found that nickel was above the ESV in SMSV-2069 while ESOP did not. These locations are sampled on an annual basis. Additional data will enable ESOP to trend metals in these and other locations. Due to the highly variable nature of metals in sediment (Alloway 1995), variations even within split samples inevitably occur. Results are depicted in Section 2.5.3, Figures 7-8.

The tables comparing results from ESOP and DOE-SR is in Section 2.5.3, Tables 11-13.

Statistical Analysis

Background (B) sample averages were subtracted from perimeter (E) sample averages to determine the SRS random environmental concentrations above background (Section 2.5.3, Tables 7-9). If this number was greater than zero and the radionuclide was associated with SRS, then further statistical analysis was conducted. Statistical analysis of data between ESOP and DOE-SR cannot be done since DOE-SR does not do random sampling. However, since ESOP collects random samples, a statistical comparison can be done between SRS perimeter and South Carolina background samples. This comparison can be used to determine the statistical significance of any differences encountered between perimeter and background samples collected by ESOP. When the random perimeter and random background samples were averaged, only Pb-212 and Pb-214 had an "E-B" average greater than zero. Neither gross alpha- nor gross beta-emitting particles averaged greater than zero. These averages were calculated to provide a more accurate characterization of the contaminant concentrations throughout the sampling area.

Nonparametric Wilcoxon Rank Sum and modified Quantile statistical tests are used to test the hypothesis that the study area (50-mile SRS perimeter) and the South Carolina background are the same for the stated radionuclide based locations. The 2007 sediments Cs-137 null hypothesis was rejected by the Wilcoxon Rank Sum at alpha 0.05 but not by the modified Quantile test (Michigan 2002; USEPA 2000a). Also, the sample number to date is insufficient to support a null hypothesis rejection in favor of the alternate hypothesis that the populations are different.

The ESOP random sample data was used to calculate "E-B" averages from the "detects only" data for metals. Seven metals had "E-B" averages greater than zero (barium, beryllium, cobalt, copper manganese, nickel and lead).

CONCLUSIONS AND RECOMMENDATIONS

ESOP will continue independent monitoring of SRS sediments and will periodically evaluate modification of the monitoring activities to better accomplish project goals and objectives. Monitoring will continue as long as there are activities at the SRS that create the potential for contamination entering the environment. Continued monitoring will provide an improved understanding of radionuclide and non-radionuclide activity in SRS sediments and the Savannah River. It will impart valuable information to human health exposure pathways. The comparison of data results allows for independent data verification of DOE-SR monitoring activities. Cooperation between DOE-SR and ESOP provides credibility and confidence in the information being provided to the public.

Additional analysis will be performed in 2008 on the publicly accessible SRS creek mouth sediments. Isotopic plutonium and total strontium 89/90 will be analyzed in these samples as well as Tc-99, gross alpha, non-volatile beta and gamma-emitting radionuclides. Metals will be evaluated in the SRS streams, especially those that were high in regard to their ESV rating. Trending of data over multiple years will give a clearer picture of any contaminants' presence and concentration. Also, ESOP will continue collecting random sediment samples from all over South Carolina. These samples will be analyzed for radiological and nonradiological

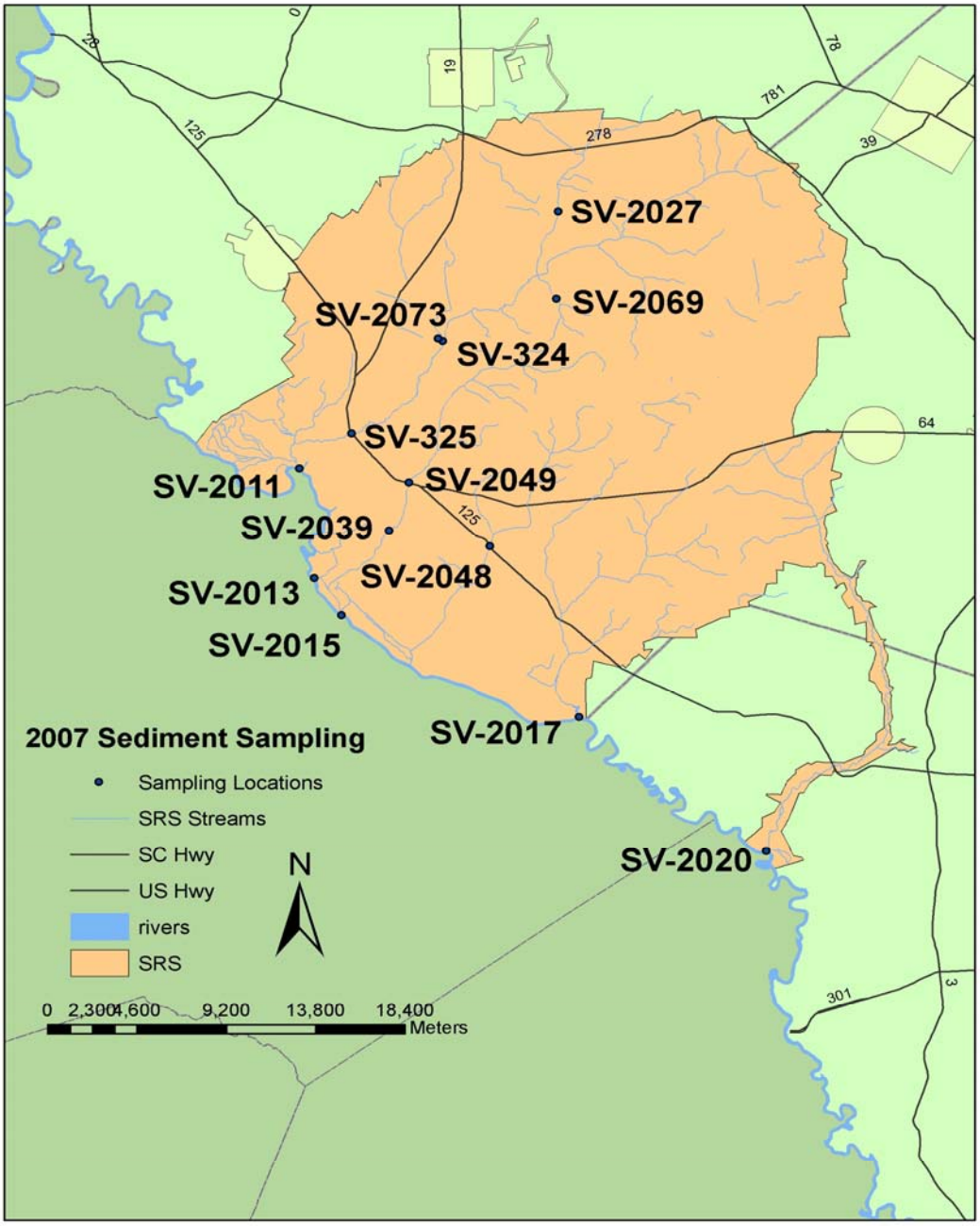
contaminants and compared to the normally sampled locations from SRS. This will give a better view as to the impacts of SRS on the streams and sediments of South Carolina.

ESOP will perform annual in-situ monitoring of the three floodplain transects and will compare to the 2007 results to see if Cs-137 net results are declining or possibly increasing due to the movement of re-suspended sediment along the floodplains.

Back to Table of Contents

2.5.2 Back to Maps

Map 7. Radiological and Nonradiological Monitoring of Sediments - SRS Locations



2.5.3 Tables and Figures

Radiological and Nonradiological Monitoring of Sediments

Table 1. ESOP Sediment Sample Locations

Sample Location	Location Description
SV-2027	Upper Three Runs @ SRS Road 2-1
SV-325	Upper Three Runs @ SC 125 (SRS Road A)
SV-2011	Upper Three Runs Mouth @ RM 157.4
SV-2073	Upper Three Runs off Road C.
SV-2069	McQueen Branch off Monroe Owens Road.
SV-324	Tims Branch at Road C.
SV-2013	Beaver Dam Creek Mouth @ RM 152.3
SV-2049	Fourmile Branch @ Road 125
SV-2039	Fourmile Branch @ Road A-13
SV-2015	Fourmile Branch @ RM 150.6
SV-2048	Pen Branch @ SC 125 (SRS Road A)
SV-2017	Steel Creek Mouth @ RM 141.5
SV-2020	Lower Three Runs Mouth @ RM 129.1
SME-001	E-001 E Area stormwater basin
SME-002	E-002 E Area stormwater basin
SME-003	E-003 E Area stormwater basin
SME-004	E-004 E Area stormwater basin
SME-005	E-005 E Area stormwater basin
SME-006	E-006 E Area stormwater basin
SME-007	E-007 E Area stormwater basin
SMZ-Basin	Stormwater basin in N.E. perimeter of Z Area

Notes:
RM = River Mile

Tables and Figures

Radiological and Nonradiological Monitoring of Sediments

Table 2. SRS Environmental Random Perimeter ("E") Inside of the 50-mile SRS Perimeter

Quad Designation	7.5' Quad Name	Latitude by Lat and Longitude by Long
E1X&B2X	Furman (50mi.)	3237.5 by 3245 and -8107.5 by -8115
E2	Barnwell	3307.5 by 3315 and -8115 by -8122.5
E3X	New Ellenton, SE (SRSX)	3315 by 3322.5 and -8130 by -8137.5
E4	Aiken	3330 by 3337.5 and -8137.5 by -8145
E5	Ehrhardt	3300 by 3307.5 and -8100 by -8107.5
E6	Foxtown	3337.5 by 3345 and -8130 by -8137.5
E7X&B24X	Emory (50mi.)	3352.5 by 3400 and -8137.5 by -8145
E8	HarleysMillPond	3330 by 3337.5 and -8107.5 by -8115
E9	Monetta	3345 by 3352.5 and -8130 by -8137.5
E10	Norway West	3322.5 by 3330 and -8107.5 by -8115
E11	North	3330 by 3337.5 and -8100 by -8107.5
E12	Colliers	3337.5 by 3345 and -8200 by -8207.5
E13	Norway East	3325.5 by 3330 and -8100 by -8107.5
E14X	Jackson (NRX/SRS)	3315 by 3322.5 and -8145 by -8152.5
E15X	Evans (GAX)	3330 by 3337.5 and -8207.5 by -8215
E16	Denmark	3315 by 3322.5 and -8107.5 by -8115
E17X&B25X	Orangeburg S. (50mi.)	3322.5 by 3330 and -8045 by -8052.5
E18	Midway	3315 by 3322.5 and -8052.5 by -8100
E19X	Mechanics Hill (GAX)	3315 by 3322.5 and -8152.5 by -8200
E20	Kitchens Mill	3330 by 3337.5 and -8122.5 by -8130
E21	Clear Pond	3307.5 by 3315and -8100 by -8107.5
E22X&B26X	Grays (50mi.)	3237.5 by 3245 and -8100 by -8107.5
E24X	Long Branch(SRS)	3315 by 3322.5 and -8122.5 by -8130
E25X&B53X	Clarks Hill(GAX)	3337.5 by 3345 and -8207.5 by -8215
E26X&B27X	Parksville (50mi.)	3345 by 3352.5 and -8207.5 by -8215
E27	Roper's Crossroads	3337.5 by 3345 and -8152.5 by -8200
E28	Salley	3330 by 3337.5 and -8115 by -8122.5

Tables and Figures

Radiological and Nonradiological Monitoring of Sediments

Table 3. South Carolina Random Background ("B") Outside of the 50-mile SRS Perimeter

Quad Designation	7.5' Quad Name	Latitude by Lat and Longitude by Long
B2X&E1X	Furman (50mi.)	3237.5 by 3245 and -8107.5 by -8115
B3	Felderville	3322.5 by 3330 and -8030 by -8037.5
B4	James Is.	3237.5 by 3245 and -7952.5 by -8000
B5	Carlisle	3430 by 3437.5 and -8122.5 by -8130
B6	Antreville	3415 by 3422.5 and -8230 by -8237.5
B7X	Saluda (NCX)	3507.5 by 3515 and -8215 by -8222.5
B8	Bingham	3422.5 by 3430 and -7930 by -7937.5
B9	Alvin	3315 by 3322.5 and -7945 by -7952.5
B10	Jamestown	3315 by 3322.5 and -7937.5 by -7945
B11	North Is.	3315 by 3322.5 and -7907.5 by -7915
B12	Summerton	3330 by 3337.5 and -8015 by -8022.5

Tables and Figures

Radiological and Nonradiological Monitoring of Sediments

Table 4. Radioisotopes analyzed in sediment in 2007.

Radioisotope	Abbreviation
Actinium-228	Ac-228
Americium-241	Am-241
Berylium-7	Be-7
Cerium-144	Ce-144
Cobalt-58	Co-58
Cobalt-60	Co-60
Cesium-134	Cs-134
Cesium-137	Cs-137
Europium-152	Eu-152
Europium-154	Eu-154
Europium-155	Eu-155
Iodine-131	I-131
Potassium-40	K-40
Manganese-54	Mn-54
Sodium-22	Na-22
Lead-212	Pb-212
Lead-214	Pb-214
Radium-226	Ra-226
Ruthenium-103	Ru-103
Antimony-125	Sb-125
Thorium-234	Th-234
Ytrium-88	Y-88
Zinc-65	Zn-65
Zirconium-95	Zr-95

Tables and Figures

Radiological and Nonradiological Monitoring of Sediments

Table 5. Metals and Pesticides/PCBs analyzed in SRS sediments in 2007.

Organic Pesticide Analysis	MDL	UNITS
Aldrin	0.0020	mg/kg
alpha-BHC	0.0020	mg/kg
beta-BHC	0.0020	mg/kg
Chlordane	0.015	mg/kg
delta-BHC	0.0020	mg/kg
Dieldrin	0.0020	mg/kg
Endosulfan I	0.0020	mg/kg
Endosulfan II	0.0020	mg/kg
Endosulfan Sulfate	0.0020	mg/kg
Endrin	0.0020	mg/kg
Endrin aldehyde	0.0020	mg/kg
Heptachlor	0.0020	mg/kg
Heptachlor epoxide	0.0020	mg/kg
Lindane	0.0020	mg/kg
p,p'-DDD	0.0020	mg/kg
p,p'-DDE	0.0020	mg/kg
p,p'-DDT	0.0020	mg/kg
PCB 1016	0.015	mg/kg
PCB 1221	0.030	mg/kg
PCB 1232	0.015	mg/kg
PCB 1242	0.015	mg/kg
PCB 1248	0.015	mg/kg
PCB 1254	0.015	mg/kg
PCB 1260	0.015	mg/kg
Toxaphene	0.070	mg/kg

Inorganic Metal Analysis	MDL	UNITS
Aluminum in Sediment	10	mg/kg
Cadmium in Sediment	1.0	mg/kg
Cobalt in Sediment	2.0	mg/kg
Chromium in Sediment	1.0	mg/kg
Copper in Sediment	1.0	mg/kg
Iron in Sediment	2.0	mg/kg
Mercury in Sediment	0.10	mg/kg
Magnesium in Sediment	5.0	mg/kg
Manganese in Sediment	1.0	mg/kg
Nickel in Sediment	2.0	mg/kg
Lead in Sediment	5.0	mg/kg
Zinc in Sediment	1.0	mg/kg

Tables and Figures

Radiological and Nonradiological Monitoring of Sediments

Table 6. Base Neutral/Acid Extractable Organics (BNA) analyzed in SRS sediments in 2007.

Organic BNA Analysis	MDL	UNITS
1,2,4-trichlorobenzene	0.30	mg/kg
1,2-dichlorobenzene	0.30	mg/kg
1,3-dichlorobenzene	0.30	mg/kg
1,4-dichlorobenzene	0.30	mg/kg
2,4,5-trichlorophenol	0.30	mg/kg
2,4,6-trichlorophenol	0.30	mg/kg
2,4-dichlorophenol	0.30	mg/kg
2,4-dimethyl phenol	0.30	mg/kg
2,4-Dinitrophenol	0.30	mg/kg
2,4-dinitrotoluene	0.30	mg/kg
2,6-dinitrotoluene	0.30	mg/kg
2-chloronaphthalene	0.30	mg/kg
2-chlorophenol	0.30	mg/kg
2-methyl naphthalene	0.30	mg/kg
2-methyl-4,6-dinitrophenol	0.30	mg/kg
2-methylphenol	0.30	mg/kg
2-nitroaniline	0.30	mg/kg
2-nitrophenol	0.30	mg/kg
3,3'-dichlorobenzidine	0.30	mg/kg
3-nitroaniline	0.30	mg/kg
4-bromophenyl phenyl ether	0.30	mg/kg
4-chloro-3 methyl phenol	0.30	mg/kg
4-chloroaniline	0.30	mg/kg
4-chlorophenyl phenyl ether	0.30	mg/kg
4-methylphenol	0.30	mg/kg
4-nitroaniline	0.30	mg/kg
4-nitrophenol	0.30	mg/kg
Acenaphthene	0.30	mg/kg
Acenaphthylene	0.30	mg/kg
Aniline	0.30	mg/kg
Anthracene	0.30	mg/kg
Azobenzene	0.30	mg/kg
Benzo(a)anthracene	0.30	mg/kg
Benzo(a)pyrene	0.30	mg/kg

Organic BNA Analysis	MDL	UNITS
Benzo(b)fluoranthene	0.30	mg/kg
Benzo(ghi)perylene	0.30	mg/kg
Benzo(k)fluoranthene	0.30	mg/kg
Benzoic acid	0.30	mg/kg
Benzyl alcohol	0.30	mg/kg
Bis(2-chloroethoxy)methane	0.30	mg/kg
Bis(2-chloroethyl)ether	0.30	mg/kg
Bis(2-chloroisopropyl)ether	0.30	mg/kg
Bis(2-ethylhexyl)phthalate	0.30	mg/kg
Butylbenzyl phthalate	0.30	mg/kg
Chrysene	0.30	mg/kg
Dibenzo(a,h)anthracene	0.30	mg/kg
Dibenzofuran	0.30	mg/kg
Diethyl phthalate	0.30	mg/kg
Dimethyl phthalate	0.30	mg/kg
Di-n-butylphthalate	0.30	mg/kg
Di-n-octylphthalate	0.30	mg/kg
Fluoranthene	0.30	mg/kg
Fluorene	0.30	mg/kg
Hexachlorobenzene	0.30	mg/kg
Hexachlorobutadiene	0.30	mg/kg
Hexachlorocyclopentadiene	0.30	mg/kg
Hexachloroethane	0.30	mg/kg
Indeno(1,2,3-cd)pyrene	0.30	mg/kg
Isophorone	0.30	mg/kg
Naphthalene	0.30	mg/kg
Nitrobenzene	0.30	mg/kg
N-nitrosodimethylamine	0.30	mg/kg
N-nitrosodi-n-propylamine	0.30	mg/kg
N-nitrosodiphenylamine	0.30	mg/kg
Pentachlorophenol	0.30	mg/kg
Phenanthrene	0.30	mg/kg
Phenol	0.30	mg/kg
Pyrene	0.30	mg/kg

Tables and Figures

Radiological and Nonradiological Monitoring of Sediments

Table 7. Gamma Statistics for random SRS perimeter and SC background sediment samples collected in 2007. Units are in picocuries per gram (pCi/g).

		Perimeter Samples (<50 miles)			Background Samples (>50 miles)			E-B	E-B
		Average	St. Deviation	Median	Average	St. Deviation	Median	Average	Median
K-40	D Only	**4.75**	**6.32**	**1.62**	**10.03**	**14.24**	**5.08**	-5.29	-3.46
	D+ 0.5 MDA ND	**4.23**	**6.13**	**1.53**	**10.03**	**14.24**	**5.08**	-5.81	-3.55
Cs-137	D Only	**0.11**	**0.09**	**0.07**	**0.28**	**0.35**	**0.28**	-0.17	-0.21
	D+ 0.5 MDA ND	**0.04**	**0.07**	**0.01**	**0.06**	**0.15**	**0.02**	-0.03	-0.01
Pb-212	D Only	**1.31**	**0.75**	**1.17**	**0.86**	**0.84**	**0.62**	**0.45**	**0.55**
	D+ 0.5 MDA ND	**1.02**	**0.86**	**0.88**	**0.71**	**0.82**	**0.49**	**0.31**	**0.39**
Pb-214	D Only	**0.93**	**0.47**	**0.79**	**0.82**	**0.61**	**0.60**	**0.11**	**0.19**
	D+ 0.5 MDA ND	**0.93**	**0.47**	**0.79**	**0.82**	**0.61**	**0.60**	**0.11**	**0.19**
Ra-226	D Only	**2.03**	**1.08**	**1.72**	**2.50**	**1.09**	**2.16**	-0.47	-0.44
	D+ 0.5 MDA ND	**1.89**	**1.15**	**1.69**	**1.30**	**1.35**	**0.44**	**0.59**	**1.25**
Ac-228	D Only	**1.13**	**0.75**	**0.95**	**1.39**	**0.69**	**1.23**	-0.25	-0.28
	D+ 0.5 MDA ND	**1.09**	**0.77**	**0.87**	**0.80**	**0.83**	**0.62**	**0.29**	**0.25**
Th-234	D Only	**3.70**	N/A	**3.70**	N/A	N/A	N/A	N/A	N/A
	D+ 0.5 MDA ND	**0.46**	**0.68**	**0.28**	**0.74**	**0.38**	**0.88**	-0.28	-0.61
Am-241	D Only	N/A	N/A	N/A	**0.25**	N/A	**0.25**	N/A	N/A
	D+ 0.5 MDA ND	**0.09**	**0.07**	**0.08**	**0.24**	**0.10**	**0.25**	-0.15	-0.17

Note: Units are in picocuries per gram (pCi/g).

Table 8. Alpha and beta statistics for random SRS perimeter and SC background sediment samples collected in 2007. Units are in picocuries per gram (pCi/g).

	Perimeter Samples (<50 Miles)			Background Samples (>50 Samples)			E-B	E-B
	Average	St. Deviation	Median	Average	St. Deviation	Median	Average	Median
Alpha	**20**	**3.2**	**20.3**	**22.3**	N/A	**22.3**	-2.30	-2.00
Beta	**17.5**	**4.7**	**17**	**17.7**	**13.5**	**14.25**	-0.20	**2.75**

Note: Units are in picocuries per gram (pCi/g).

Tables and Figures

Radiological and Nonradiological Monitoring of Sediments

Table 9. Metals statistics for Random SRS perimeter and SC background sediment samples collected in 2007. Units are in milligrams per kilogram (mg/kg).

	Perimeter Samples (<50 Miles)			Background Samples (>50 Miles)			E-B	E-B
	Average	St. Deviation	Median	Average	St. Deviation	Median	Average	Median
Aluminum	4400.37	7139.47	1500	7611.82	9163.34	2800	-3211.45	-1300.00
Barium	39.65	70.18	17.5	35.82	34.25	14	3.83	3.50
Beryllium	0.54	0.13	0.55	0.42	0.09	0.415	0.12	0.14
Cadmium	5.73	8.33	2.5	8.18	4.57	7.9	-2.45	-5.40
Cobalt	10.78	6.18	9.3	6.04	3.23	4.9	4.74	4.40
Chromium	7.92	12.24	4.05	11.75	11.57	9.1	-3.83	-5.05
Copper	7.58	7.90	4.4	5.48	3.38	6	2.11	-1.60
Iron	5257.41	11765.18	1000	5933.91	6344.64	3400	-676.50	-2400.00
Mercury	0.20	N/A	0.2	N/A	N/A	N/A	N/A	N/A
Magnesium	279.00	511.56	54	486.93	677.58	300	-207.93	-246.00
Manganese	400.77	1741.29	18	99.62	93.77	68	301.16	-50.00
Molybdenum	2.30	N/A	2.3	2.30	N/A	2.3	0.00	0.00
Nickel	6.66	3.47	6	5.72	2.27	5.3	0.94	0.70
Lead	15.98	21.53	8.8	13.05	7.37	10.65	2.93	-1.85
Titanium	136.16	164.69	69	213.00	213.13	130	-76.84	-61.00
Vanadium	13.47	22.99	3.6	23.24	19.35	16	-9.77	-12.40
Zinc	11.55	13.44	3.85	14.07	12.18	8.2	-2.52	-4.35

Note: Units are in milligrams per kilogram (mg/kg).

Tables and Figures

Radiological and Nonradiological Monitoring of Sediments

Table 10. NaI Field Counts

LTRC 1	NaI Gross Counts	NaI Background Counts	NaI Net Counts
Location	Counts/Second	Counts/Second	Counts/Second
1	123	68	55
2	162	118	44
3	1933	821	1112
4	539	303	236
5	477	326	151
6	1419	760	659
7	1610	644	966
8	555	315	240
9	127	96	31
10	62	47	15

LTRC 2	NaI Gross Counts	NaI Background Counts	NaI Net Counts
Location	Counts/Second	Counts/Second	Counts/Second
1	88	49	39
2	221	85	136
3	240	124	116
4	534	200	334
5	697	268	429
6	618	200	418
7	733	317	416
8	896	403	493
9	489	230	259
10	438	174	264

Creek Plantation	NaI Gross Counts	NaI Background Counts	NaI Net Counts
Location	Counts/Second	Counts/Second	Counts/Second
1	582	238	344
2	606	337	269
3	1094	537	557
4	1172	569	603
5	1764	679	1085
6	1140	560	580
7	1238	658	580
8	1286	600	686
9	1348	689	659
10	730	365	365
11	68	44	24

Tables and Figures

Radiological and Nonradiological Monitoring of Sediments

Table 11. SCDHEC and DOE-SR Radiological Data for Split Stream Sediment Samples

SCDHEC-ESOP

Sample ID	K-40	Co-60	Cs-137	Pb-212	Pb-214	Ra-226	Ac-228	Th-234	Am-241
SMSV-325	ND	ND	0.080	ND	2.738	5.189	1.480	ND	ND
SMSV-2049	1.262	ND	0.324	0.615	0.409	1.262	0.662	0.449	ND
SMSV-2039	ND	ND	0.231	ND	0.167	ND	ND	ND	ND
SMSV-2048	1.392	ND	0.103	10.130	2.778	5.744	5.070	ND	ND
SMSV-2027	ND	ND	ND	2.299	1.112	2.287	2.127	ND	ND
SMSV-2069	4.071	ND	0.338	2.301	3.615	7.618	2.403	ND	ND
SMSV-2073	1.529	ND	ND	ND	4.810	9.687	2.555	ND	ND
SMSV-2020	14.480	ND	0.950	1.209	1.276	2.403	1.120	ND	ND
SMSV-2011	12.590	ND	0.126	ND	1.509	2.495	1.248	4.022	ND
SMSV-2015	15.300	ND	2.267	1.069	1.194	2.754	1.006	ND	ND
SMSV-2017	14.900	ND	1.513	1.771	1.376	2.932	1.697	ND	ND
SMSV-2013	15.620	ND	ND	1.025	1.003	2.147	1.104	ND	ND
SMSV-324	ND	ND	ND	2.628	1.501	3.007	2.729	ND	ND
AVG	9.016	NA	0.659	2.561	1.807	3.960	1.933	2.235	NA
MEDIAN	12.590	NA	0.324	1.771	1.376	2.843	1.589	2.235	NA
STD	6.700	NA	0.769	2.921	1.320	2.562	1.194	2.527	NA

DOE-SR

Sample ID	K-40	Co-60	Cs-137	Pb-212	Pb-214	Ra-226	Ac-228	Th-234	Am-241
SMSV-325	0.783	ND	0.078	1.250	2.610	3.810	1.330	ND	0.002
SMSV-2049	0.738	ND	0.318	0.413	0.441	1.920	0.610	ND	0.003
SMSV-2039	ND	ND	0.212	0.137	0.168	ND	ND	ND	0.005
SMSV-2048	1.080	ND	ND	4.880	3.360	9.010	5.600	3.790	ND
SMSV-2027	1.270	ND	ND	1.830	1.990	4.790	1.990	ND	ND
SMSV-2069	3.770	ND	0.233	1.720	3.580	8.710	2.060	ND	0.019
SMSV-2073	2.010	ND	0.102	2.200	5.240	ND	2.910	ND	0.007
SMSV-2020	13.800	ND	0.844	1.060	1.140	2.970	1.010	ND	ND
SMSV-2011	12.500	ND	0.091	0.787	1.440	3.350	0.898	ND	0.006
SMSV-2015	15.700	ND	2.210	0.891	1.160	2.750	1.120	ND	ND
SMSV-2017	15.900	ND	1.470	1.320	1.320	3.200	1.510	ND	0.002
SMSV-2013	15.400	ND	ND	0.881	0.960	2.810	1.030	ND	ND
SMSV-324	ND	ND	ND	6.840	3.430	5.710	7.380	ND	0.057
AVG	7.541	NA	0.618	1.862	2.065	4.457	2.287	3.790	0.013
MEDIAN	3.770	NA	0.233	1.250	1.440	3.350	1.420	3.790	0.005
STD	6.927	NA	0.754	1.903	1.480	2.408	2.095	NA	0.019

Tables and Figures
Radiological and Nonradiological Monitoring of Sediments

Table 12. SCDHEC and DOE-SR Radiological Data for Split Stormwater Basin Sediment Samples

SCDHEC-ESOP

Sample ID	K-40	Co-60	Cs-137	Pb-212	Pb-214	Ra-226	Ac-228	Th-234	Am-241
SME-001	**0.400**	ND	**0.095**	ND	**0.482**	**1.530**	**0.774**	ND	ND
SME-002	**0.976**	ND	**0.154**	**1.555**	**1.884**	**4.504**	**1.534**	ND	ND
SME-003	ND	ND	**0.141**	ND	**0.640**	**1.249**	**0.653**	ND	ND
SME-004	**3.295**	ND	ND	**1.689**	**0.928**	**2.457**	**1.796**	ND	ND
SME-005	ND	ND	ND	**0.373**	**0.488**	ND	ND	ND	ND
SME-006	**3.316**	ND	ND	**1.760**	**1.048**	**2.229**	**1.551**	ND	ND
SMZ-BASIN	**1.087**	ND	**1.369**	ND	**0.744**	**2.054**	**0.888**	ND	ND
AVG	**1.815**	NA	**0.440**	**1.344**	**0.888**	**2.337**	**1.199**	NA	NA
MEDIAN	**1.087**	NA	**0.148**	**1.622**	**0.744**	**2.142**	**1.211**	NA	NA
STD	**1.386**	NA	**0.620**	**0.653**	**0.487**	**1.152**	**0.483**	NA	NA

DOE-SR

Sample ID	K-40	Co-60	Cs-137	Pb-212	Pb-214	Ra-226	Ac-228	Th-234	Am-241
SWDF Basin South (E-001)	**5.590**	ND	**0.311**	**2.710**	**1.960**	**6.480**	**3.020**	**3.180**	**0.011**
SWDF Basin North (E-002)	**1.620**	ND	ND	**1.330**	**0.889**	**2.980**	**1.470**	ND	**0.015**
EAV Basin South (E-003)	**3.270**	ND	**0.104**	**1.150**	**0.800**	**1.940**	**1.170**	**0.955**	**0.015**
EAV Basin North (E-004)	**2.720**	ND	ND	**2.450**	**1.310**	**3.610**	**2.560**	ND	**0.008**
E-05	**2.300**	ND	**0.180**	**1.940**	**1.380**	**3.710**	**2.060**	ND	**0.002**
E-06	**4.000**	ND	ND	**2.090**	**1.440**	ND	**1.900**	ND	**0.012**
Z-AREA BASIN	**2.270**	ND	**1.480**	**1.010**	**0.874**	ND	**1.060**	**1.040**	**0.002**
AVG	**3.110**	NA	**0.519**	**1.811**	**1.236**	**3.744**	**1.891**	**1.725**	**0.009**
MEDIAN	**2.720**	NA	**0.246**	**1.940**	**1.310**	**3.610**	**1.900**	**1.040**	**0.011**
STD	**1.336**	NA	**0.647**	**0.661**	**0.415**	**1.684**	**0.723**	**1.261**	**0.006**

Tables and Figures
Radiological and Nonradiological Monitoring of Sediments

Table 13. SCDHEC and DOE-SR Nonradiological Data for Split Stream Sediment Samples

SCDHEC-ESOP

Sample Location:	Aluminum	Chromium	Copper	Iron	Magnesium	Manganese	Nickel	Lead	Zinc
SMSV-2011	6400	12	8.4	9400	1500	1500	5.4	9.6	34
SMSV-2013	6100	9.9	6.0	8200	1100	900	5.2	10	27
SMSV-2015	5200	10	6.2	9300	1100	830	4.2	11	31
SMSV-2017	7700	13	8.8	12000	1500	710	5.8	16	34
SMSV-2020	9500	12	6.4	9400	1200	610	5.9	15	32
SMSV-2027	2200	3.3	2.0	690	96	7.8	3.8	6.6	10
SMSV-2069	6600	9.8	3.3	5300	250	46	4.6	12	100
SMSV-2073	14000	23	69	17000	570	730	17	26	93
SMSV-324	580	1.8	ND	610	23	88	ND	ND	ND
SMSV-325	1600	2.8	ND	580	72	14	2.4	ND	12
SMSV-2049	490	1.2	2.4	1600	110	65	ND	ND	8.4
SMSV-2039	280	1.8	ND	790	16	60	ND	ND	3.7
SMSV-2048	15000	23	9.2	9000	340	760	7.1	29	59
AVG	5819	9.5	12.2	6452	606	486	6.1	15.0	37.0
MEDIAN	6100	9.9	6.3	8200	340	610	5.3	12.0	31.5
STD	4892	7.4	20.1	5290	586	473	4.0	7.6	31.7

DOE-SR

Sample Location:	Aluminum	Chromium	Copper	Iron	Magnesium	Manganese	Nickel	Lead	Zinc
2011	14000	17	9.1	14000	1500	1200	9.4	8.5	46
2013	12000	15	8.5	13000	1300	1100	8.0	7.5	43
2015	11000	15	6.9	14000	1300	780	6.9	7.9	41
2017	13000	17	8.0	16000	1500	880	7.9	8.8	45
2020	12000	17	6.3	14000	1700	680	7.6	7.1	45
2027	390	1.2	ND	280	ND	2.8	ND	1.2	3.6
2069	21000	32	69	23000	ND	650	19	17	110
2073	9800	13	4.1	8300	ND	37	6.0	8.5	21
324	420	1.7	ND	390	ND	18	ND	1.8	4.1
325	15	3.7	1.0	860	ND	16	3.2	3.6	15
2049	14	1.8	0.64	4500	760	170	ND	1.4	33
2039	13	0.88	ND	290	ND	22	ND	0.42	18
2048	26	13	3.6	9300	ND	360	ND	6.9	31
AVG	7206	11.4	11.7	9071	1343	455	8.5	6.2	35.1
MEDIAN	9800	13.0	6.6	9300	1400	360	7.8	7.1	33.0
STD	7282	9.2	20.3	7354	323	446	4.6	4.5	27.2

Tables and Figures
Radiological and Nonradiological Monitoring of Sediments

Figure 1. Trending Data for Cs-137 in Sediment

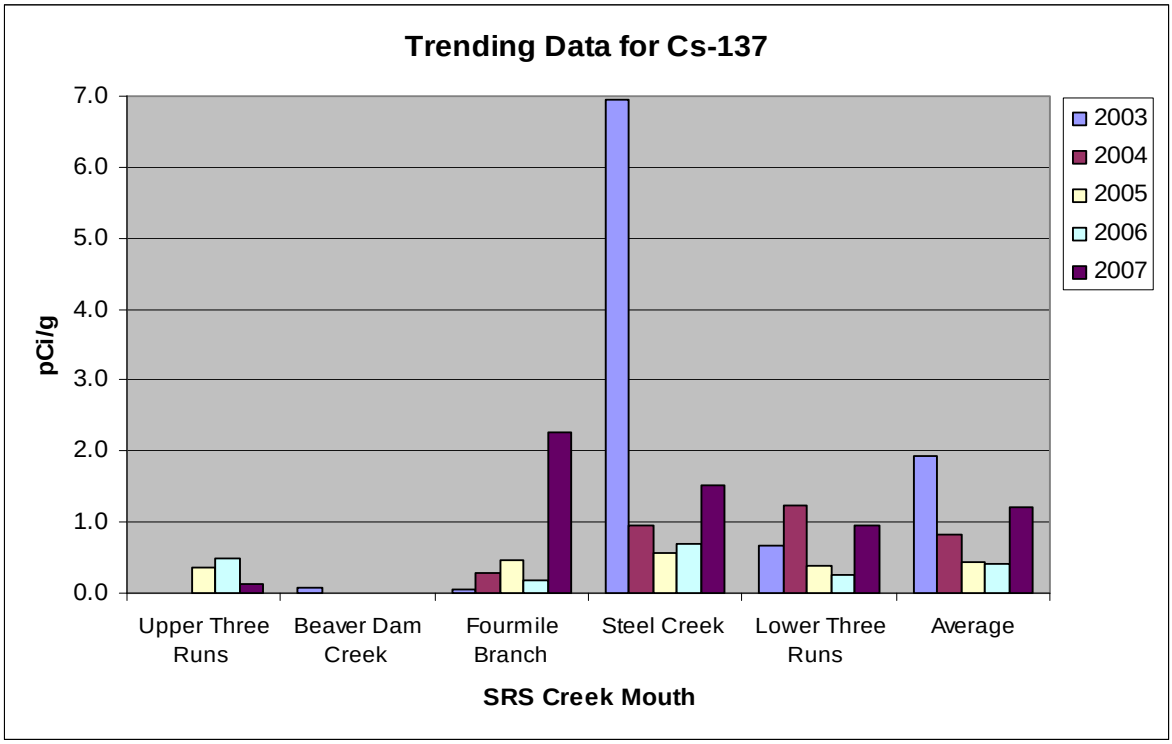
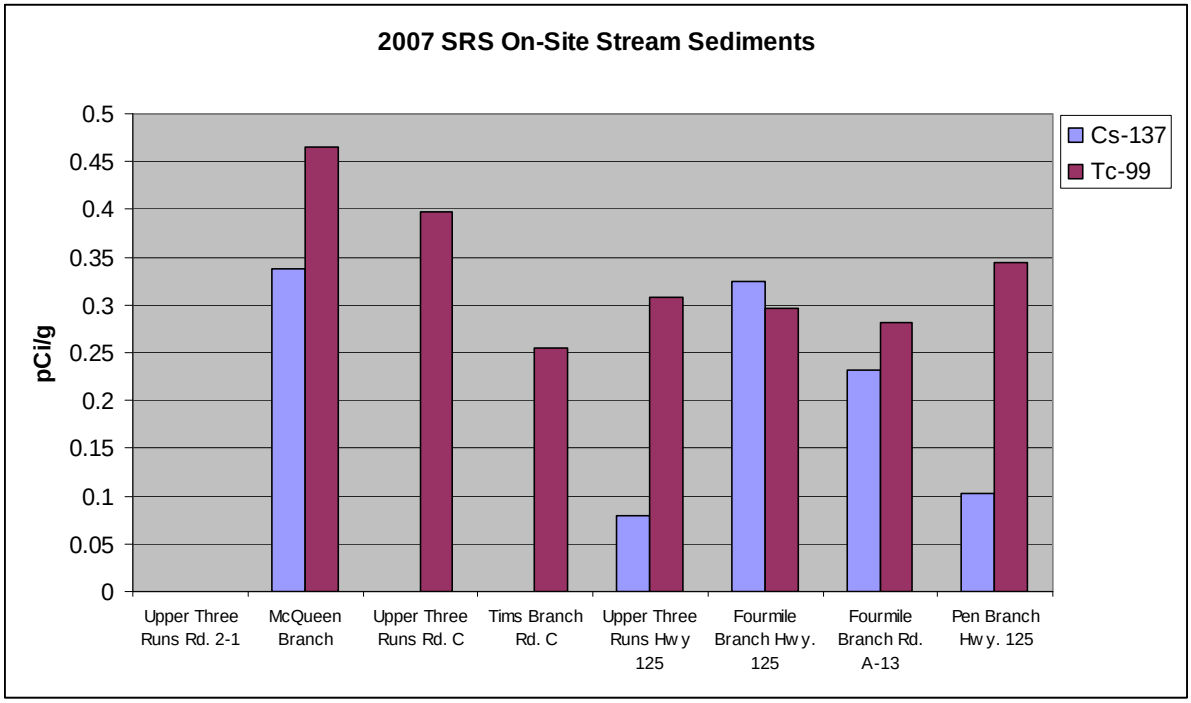


Figure 2. Gamma Data for SRS Stream Sediments



Tables and Figures
Radiological and Nonradiological Monitoring of Sediments

Figure 3. Gamma Data for Savannah River Creek Mouths

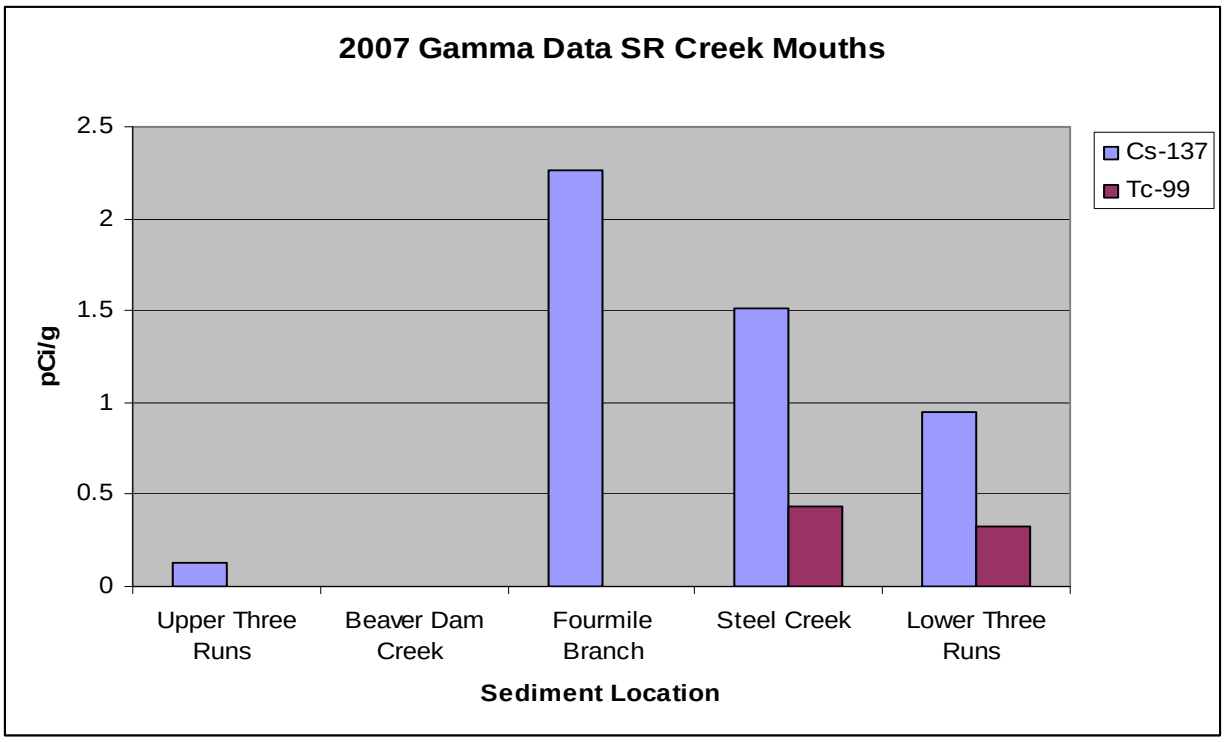
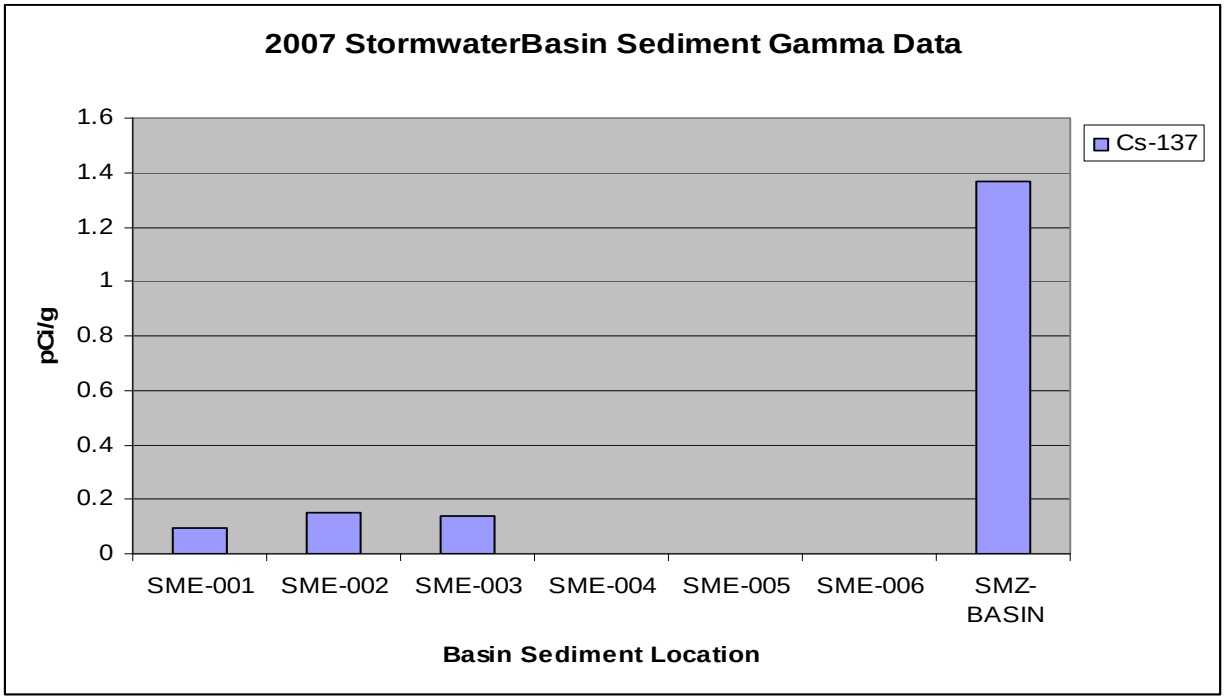


Figure 4. Gamma Data for SRS Stormwater Basins



Tables and Figures
Radiological and Nonradiological Monitoring of Sediments

Figure 5. SCDHEC / DOE-SR Comparison of Cs-137 by Stream and Creek Mouth Location

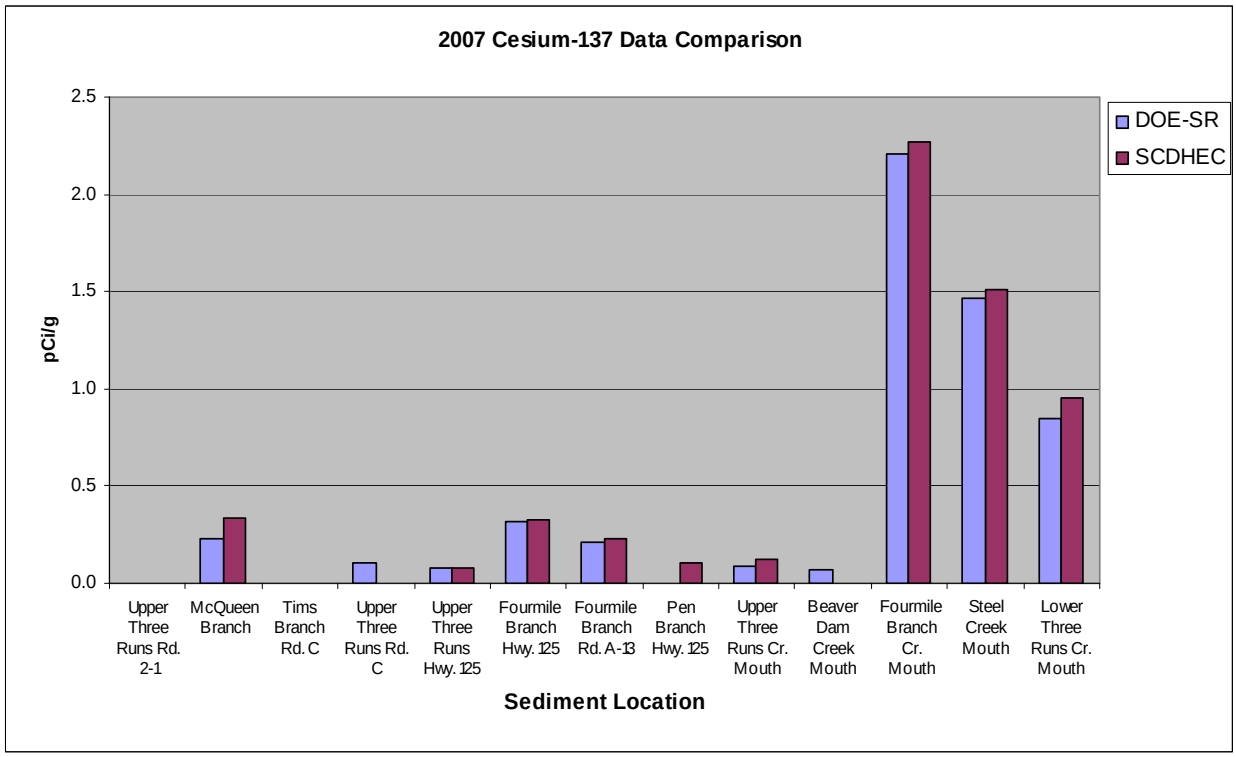
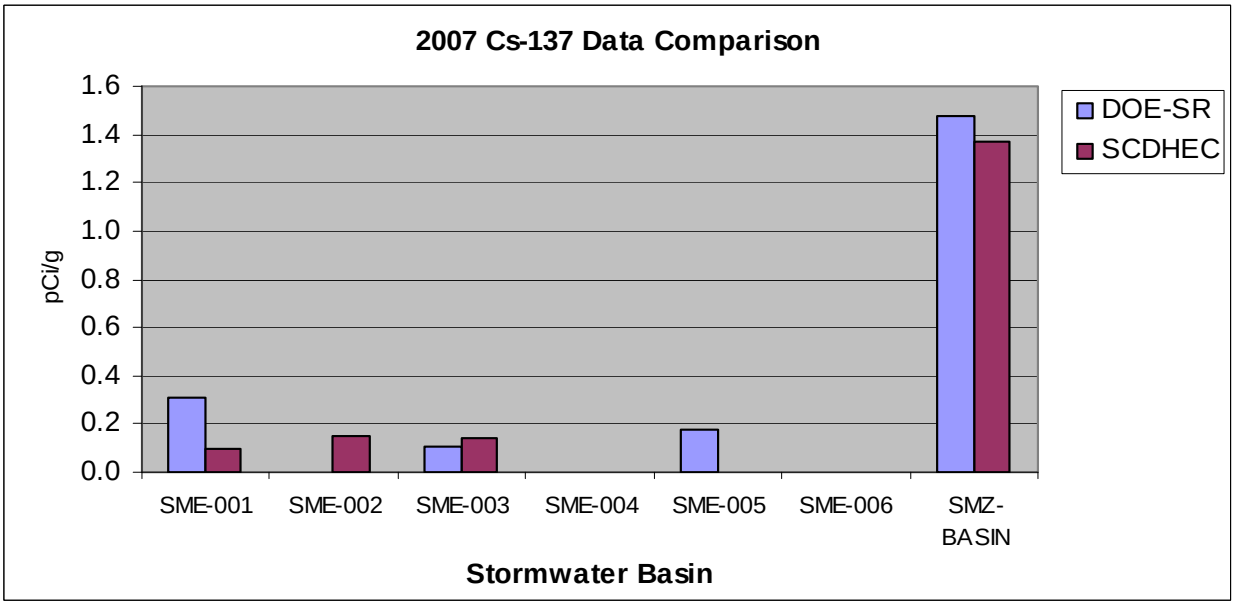


Figure 6. SCDHEC / DOE- SR Comparison of Cs-137 by Stormwater Basin Location



Tables and Figures
Radiological and Nonradiological Monitoring of Sediments

Figure 7. SCDHEC Metals Data by Locations Sampled Annually

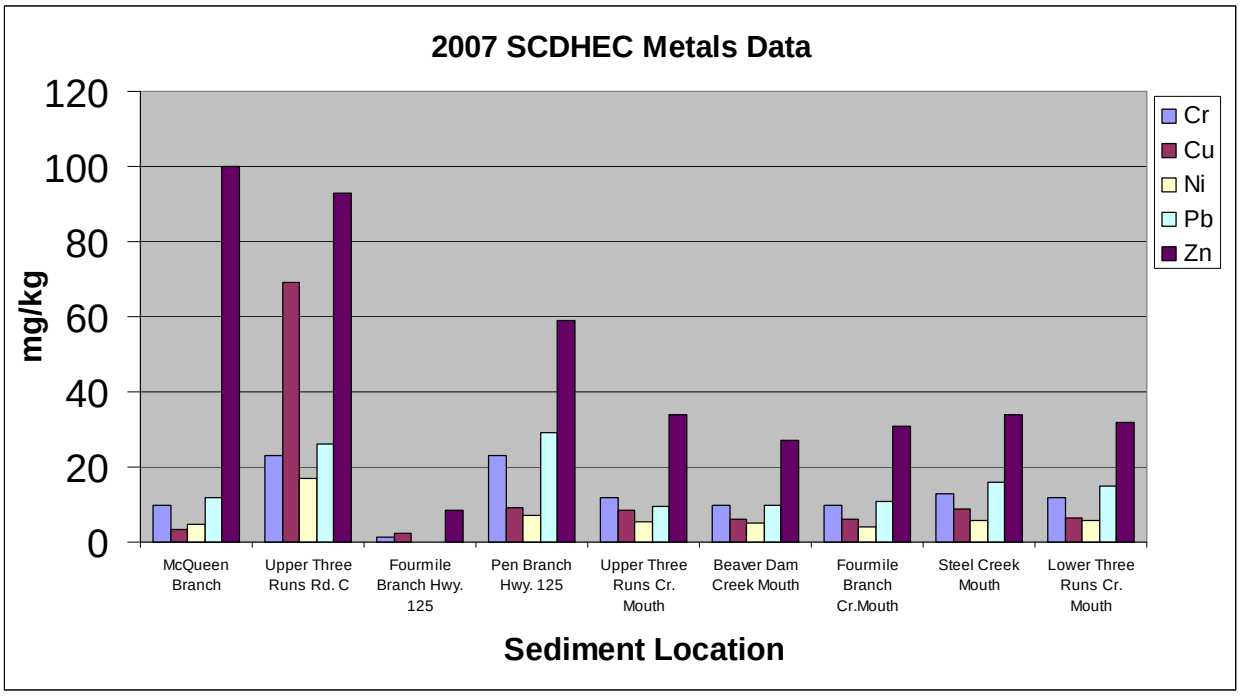
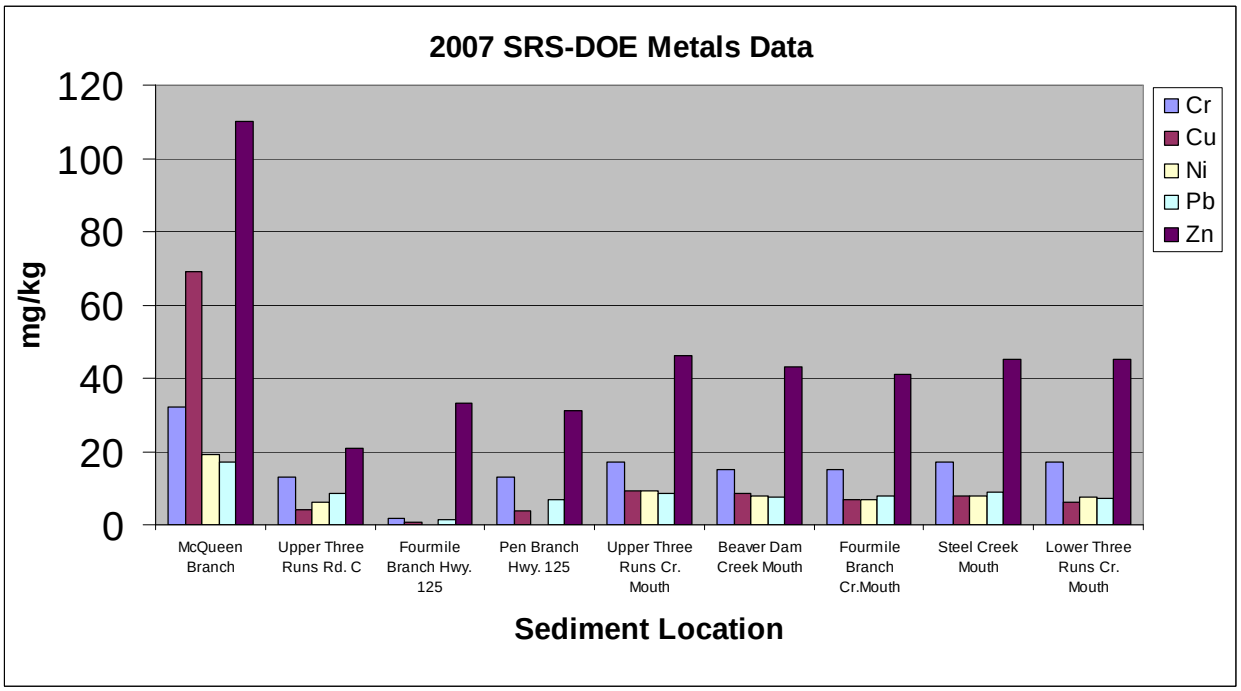
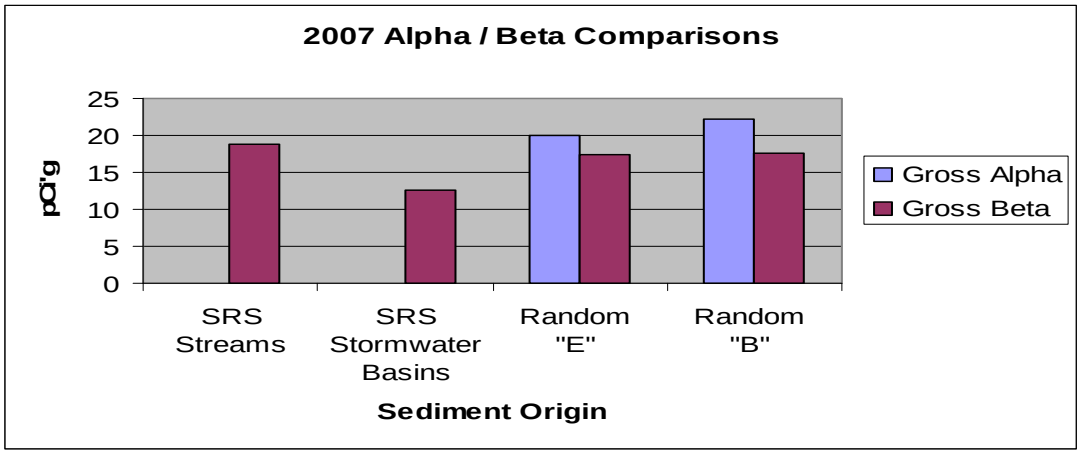


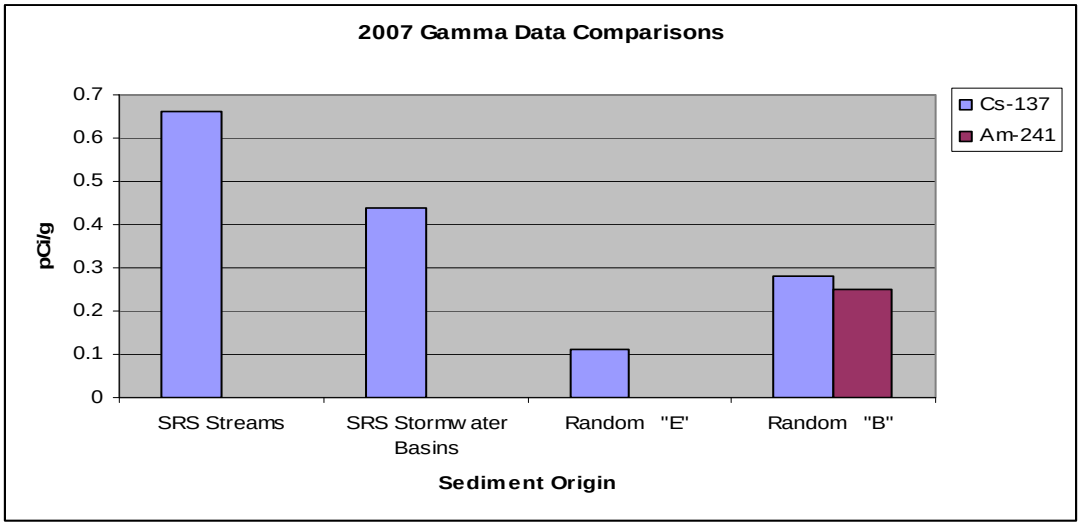
Figure 8. DOE-SR Metals Data by Locations Sampled Annually

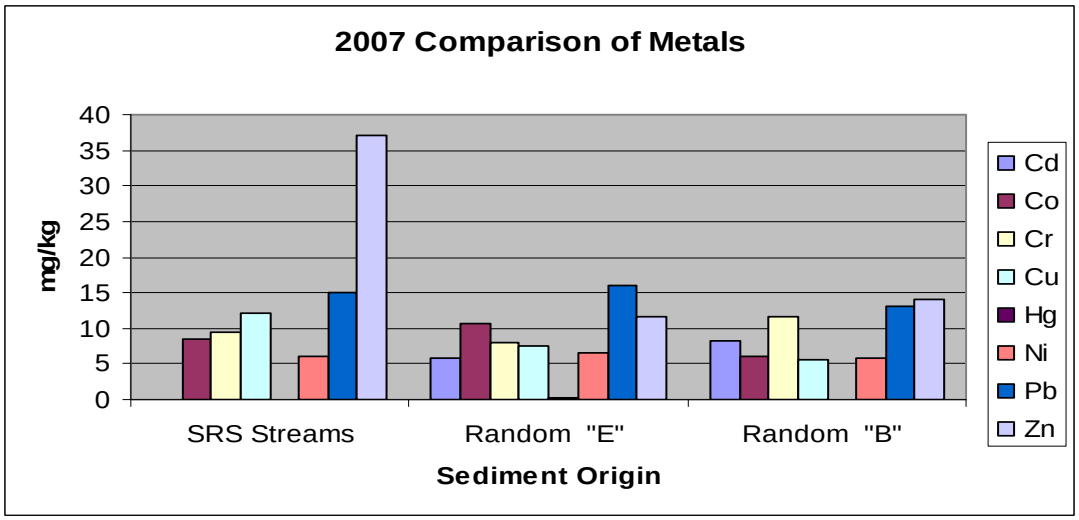


Tables and Figures

Figures 9 - 11. 2007 SCDHEC Comparative Data of Sample Groups







Tables and Figures
Radiological and Nonradiological Monitoring of Sediments

Figure 12. NaI Field Measurements Compared to Standard Analytical Results for Cs-137

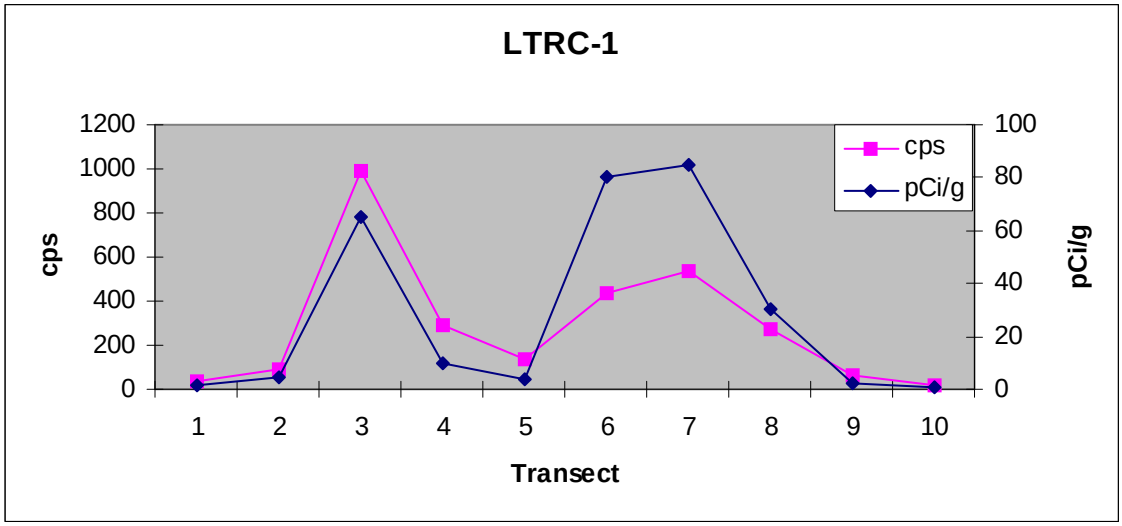
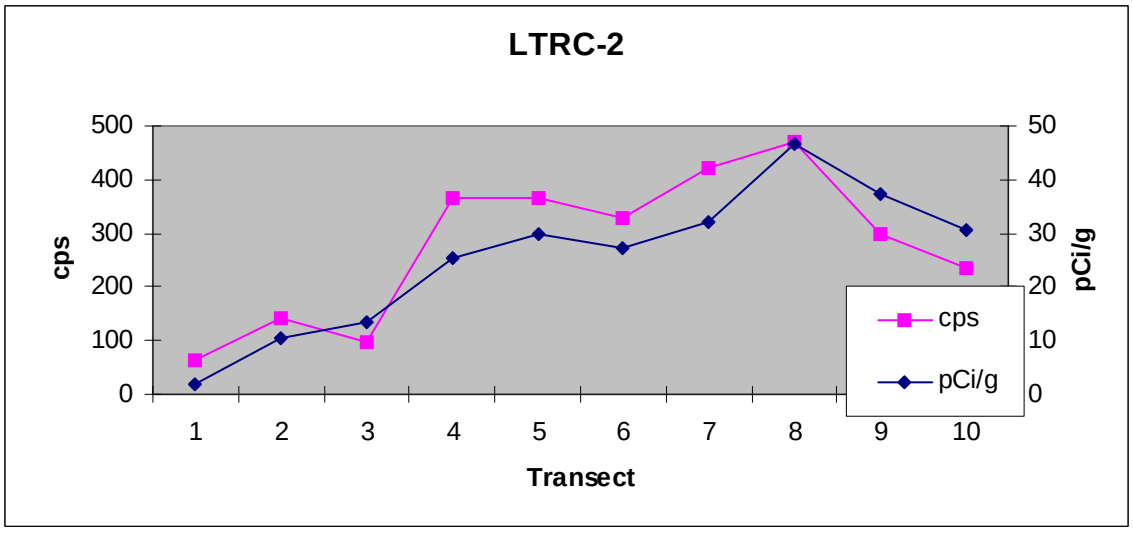


Figure 13. NaI Field Measurements Compared to Standard Analytical Results for Cs-137



Back to Tables and Figures

2.5.4 Data

Radiological and Nonradiological Monitoring of Sediments

2007 Radiological Data 176

2007 Nonradiological Data 193

Notes:

1. Bold numbers denotes a detection.
2. A blank field following ±2 SIGMA occurs when the sample is <LLD.
3. LLD= Lower Limit of Detection
4. MDA= Minimum Detectable Activity

Back to List of Data Tables

Ambient Sediment Monitoring Data

2007 Sediment Radiological Analysis
Savannah River Site Creek Mouths Accessible to the Public:

Sample Location:	SMSV-2011	SMSV-2013	SMSV-2015	SMSV-2017	SMSV-2020
Date Collected:	28-Mar-07	28-Mar-07	28-Mar-07	28-Mar-07	28-Mar-07
UNITS	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Gross Alpha	<LLD	<LLD	<LLD	<LLD	<LLD
±2 Sigma					
LLD	20.8	16.4	21.8	19.6	18.5
Non Volatile Beta	**22.3**	**12.3**	**24.5**	**24.9**	**17.8**
±2 Sigma	**4.12**	**3.70**	**4.77**	**5.28**	**3.88**
LLD	**5.20**	**5.54**	**6.15**	**7.02**	**5.24**
Cesium-137	**0.1255**	<LLD	**2.267**	**1.513**	**0.9499**
Confidence Interval (±2 SD)	**0.0419**		**0.1691**	**0.1168**	**0.0849**
MDA	**0.0435**	0.0364	**0.0436**	**0.0481**	**0.0427**
Technetium-99	**e***	<MDC	<MDC	**0.432**	**0.323**
±2 Sigma				**0.156**	**0.147**
MDC		0.235	0.236	**0.246**	**0.237**

*e = error - sample damaged in shipment and not analyzed

Savannah River Site Streams That Are Not Accessible to the Public:

Sample Location:	SMSV-2027	SMSV-2069	SMSV-2073	SMSV-324
Date Collected:	21-Mar-07	21-Mar-07	21-Mar-07	21-Mar-07
UNITS	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Gross Alpha	<LLD	<LLD	<LLD	<LLD
±2 Sigma				
LLD	16.4	40.2	20.1	18.4
Non Volatile Beta	<LLD	**16.6**	**15.9**	**12.0**
±2 Sigma		**7.72**	**4.46**	**3.21**
LLD	8.56	**12.7**	**6.48**	**4.65**
Cesium-137	<LLD	**0.3384**	<LLD	<LLD
Confidence Interval (±2 SD)		**0.0492**		
MDA	0.0360	**0.0628**	0.0578	0.0398
Technetium-99	<MDC	**0.465**	**0.398**	**0.255**
±2 Sigma		**0.247**	**0.157**	**0.142**
MDC	0.243	**0.401**	**0.250**	**0.232**

Sample Location:	SMSV-325	SMSV-2049	SMSV-2039	SMSV-2048
Date Collected:	21-Mar-07	21-Mar-07	21-Mar-07	21-Mar-07
UNITS	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Gross Alpha	<LLD	<LLD	<LLD	<LLD
±2 Sigma				
LLD	19.2	16.1	18	21.6
Non Volatile Beta	**12.0**	<LLD	<LLD	**28.8**
±2 Sigma	**5.12**			**5.19**
LLD	**8.29**	7.93	4.30	**6.42**
Cesium-137	**0.0797**	**0.3238**	**0.2312**	**0.1026**
Confidence Interval (±2 SD)	**0.0302**	**0.0378**	**0.0291**	**0.0431**
MDA	**0.0420**	**0.0259**	**0.0186**	**0.0631**
Technetium-99	**0.308**	**0.296**	**0.281**	**0.345**
±2 Sigma	**0.153**	**0.147**	**0.147**	**0.161**
MDC	**0.248**	**0.239**	**0.238**	**0.259**

Ambient Sediment Monitoring Data

2007 Sediment Radiological Analysis
Savannah River Site Storm Water Basins That Are Not Accessible to the Public:

Sample Location:	**SME-001**	**SME-002**	**SME-003**	**SME-004**
Date Collected:	12-Mar-07	12-Mar-07	12-Mar-07	12-Mar-07
UNITS	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Gross Alpha	<LLD	<LLD	<LLD	<LLD
±2 Sigma				
LLD	27.7	14.5	20.5	17.7
Non Volatile Beta	**15.8**	<LLD	<LLD	**7.59**
±2 Sigma	**7.50**			**3.22**
LLD	**12.3**	4.34	<4.64	**5.22**
Cesium-137	**0.0947**	**0.1543**	**0.1409**	<LLD
Confidence Interval (±2 SD)	**0.0189**	**0.0353**	**0.0329**	
MDA	**0.0270**	**0.0493**	**0.0284**	0.0384

Sample Location:	**SME-005**	**SME-006**	**SMZ-BASIN**
Date Collected:	12-Mar-07	12-Mar-07	12-Mar-07
UNITS	(pCi/g)	(pCi/g)	(pCi/g)
Gross Alpha	<LLD	<LLD	<LLD
±2 Sigma			
LLD	24.1	22.5	22.7
Non Volatile Beta	**9.01**	**14.6**	**15.6**
±2 Sigma	**4.03**	**6.76**	**4.44**
LLD	**6.61**	**11.1**	**6.54**
Cesium-137	<LLD	<LLD	**1.369**
Confidence Interval (±2 SD)			**0.1063**
MDA	0.0277	0.04	**0.0313**

Ambient Sediment Monitoring Data
2007 Sediment Alpha Beta SRS Random Perimeter "E" Samples <50 miles

Sample Location:	**SME1**	**SME2**	**SME3**	**SME4**	**SME5**	**SME6**
Date Collected:	19-Mar-07	19-Mar-07	19-Mar-07	29-May-07	19-Mar-07	29-May-07
UNITS	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Gross Alpha	**23.5**	**15.9**	**19.4**	<LLD	<LLD	<LLD
±2 SIGMA	**14.3**	**12.4**	**17.0**			
LLD	**12.2**	**12.4**	**18.1**	30	14.4	27.2
N-V Beta	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
±2 SIGMA						
LLD	33.2	13.9	12.7	16.9	10.6	13.2

Sample Location:	**SME7**	**SME8**	**SME9**	**SME10**	**SME11**	**SME12**
Date Collected:	11-Oct-07	21-Jun-07	29-May-07	21-Jun-07	21-Jun-07	5-Mar-07
UNITS	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Gross Alpha	<LLD	<LLD	<LLD	<LLD	<LLD	**21.2**
±2 SIGMA						**13.8**
LLD	23.5	31.7	27.2	27.6	29	**12.3**
N-V Beta	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
±2 SIGMA						
LLD	8.26	17.8	19.5	13.3	10.8	11.9

Sample Location:	**SME13**	**SME14**	**SME15**	**SME16**	**SME17**	**SME18**
Date Collected:	21-Jun-07	16-Jul-07	11-Jun-07	15-Jun-07	14-Dec-07	15-Jun-07
UNITS	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Gross Alpha	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
±2 SIGMA						
LLD	27.3	22	28.4	30.3	20.1	27.4
N-V Beta	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
±2 SIGMA						
LLD	13.8	7.56	17	25	6.81	16.4

Sample Location:	**SME19**	**SME20**	**SME21**	**SME22**	**SME24**	**SME25**
Date Collected:	16-Jul-07	19-Sep-07	12-Oct-07	13-Jul-07	19-Sep-07	11-Jun-07
UNITS	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Gross Alpha	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
±2 SIGMA						
LLD	22.5	21.5	20.0	23.2	22.3	28.5
N-V Beta	**16.2**	<LLD	**23.7**	<LLD	<LLD	**17.8**
±2 SIGMA	**5.13**		**5.30**			**7.32**
LLD	**7.82**	8	**6.69**	7.82	7.4	**12.1**

Sample Location:	**SME26**	**SME27**	**SME28**
Date Collected:	11-Jun-07	11-Oct-07	19-Sep-07
UNITS	(pCi/g)	(pCi/g)	(pCi/g)
Gross Alpha	<LLD	<LLD	<LLD
±2 SIGMA			
LLD	28.4	22.5	23.3
N-V Beta	<LLD	**12.3**	<LLD
±2 SIGMA		**4.75**	
LLD	15.1	**7.56**	8.23

Ambient Sediment Monitoring Data

2007 Sediment Alpha Beta SRS Random Background "B" Samples >50 miles

Sample Location:	**SMB2**	**SMB3**	**SMB4**	**SMB5**	**SMB6**	**SMB7**
Date Collected:	19-Mar-07	20-Nov-07	25-May-07	21-Dec-07	05-Mar-07	21-Dec-07
UNITS	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Gross Alpha	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
±2 SIGMA						
LLD	<12.0	<18.8	<31.6	<20.1	<12.0	<20.3
N-V Beta	<LLD	**6.86**	<LLD	**14.7**	<LLD	**44.1**
±2 SIGMA		**3.83**		**4.57**		**6.31**
LLD	<9.89	**6.28**	<18.5	**6.53**	<11.8	**6.43**

Sample Location:	**SMB8**	**SMB9**	**SMB10**	**SMB11**	**SMB12**
Date Collected:	13-Dec-07	12-Oct-07	12-Oct-07	11-Dec-07	06-Dec-07
UNITS	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Gross Alpha	<LLD	**22.3**	<LLD	<LLD	<LLD
±2 SIGMA		**15.8**			
LLD	<19.8	**20.0**	<19.7	<19.5	<20.1
N-V Beta	<LLD	**17.6**	**13.8**	<LLD	**9.12**
±2 SIGMA		**4.77**	**4.45**		**4.21**
LLD	<6.18	**6.44**	**6.38**	<6.52	**6.65**

Ambient Sediment Monitoring Data

2007 ESOP Gamma Sediment Non-Random Data
Savannah River Site Creek Mouth Accessible to the Public:

Sample ID	SMSV-2011	SMSV-2013	SMSV-2015	SMSV-2017	SMSV-2020
Collection Date	3/28/2007	3/28/2007	3/28/2007	3/28/2007	3/28/2007
Analyte and Results	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
K-40	**12.59**	**15.62**	**15.30**	**14.90**	**14.48**
Confidence Interval (±2 SD)	**1.045**	**1.232**	**1.212**	**1.218**	**1.150**
MDA	**0.3001**	**0.2792**	**0.3240**	**0.3413**	**0.2851**
Cs-137	**0.1255**	<MDA	**2.267**	**1.513**	**0.9499**
Confidence Interval (±2 SD)	**0.0419**		**0.1691**	**0.1168**	**0.0849**
MDA	**0.0435**	0.0364	**0.0436**	**0.0481**	**0.0427**
Pb-212	<MDA	**1.025**	**1.069**	**1.771**	**1.209**
Confidence Interval (±2 SD)		**0.1046**	**0.1092**	**0.1729**	**0.1207**
MDA	0.0464	**0.0487**	**0.0546**	**0.0537**	**0.0465**
Pb-214	**1.509**	**1.003**	**1.194**	**1.376**	**1.276**
Confidence Interval (±2 SD)	**0.1025**	**0.0792**	**0.0869**	**0.0996**	**0.0847**
MDA	**0.0879**	**0.0797**	**0.0924**	**0.0975**	**0.0888**
Ra-226	**2.495**	**2.147**	**2.754**	**2.932**	**2.403**
Confidence Interval (±2 SD)	**0.7348**	**0.6394**	**0.8184**	**0.8658**	**0.7048**
MDA	**0.9271**	**0.8626**	**0.9883**	**1.081**	**0.9592**
Ac-228	**1.248**	**1.104**	**1.006**	**1.697**	**1.120**
Confidence Interval (±2 SD)	**0.1374**	**0.1107**	**0.1436**	**0.1405**	**0.1321**
MDA	**0.1477**	**0.1510**	**0.1552**	**0.1734**	**0.1517**
Th-234	**4.022**	<MDA	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)	**1.988**				
MDA	**0.5584**	0.5254	0.5831	0.6677	0.5681

Note: There were no detections for:
Am-241, Be-7, Ce-144, Co-58, Co-60, Cs-134, Eu-152, Eu-154, Eu-155, I-131, Mn-54, Na-22, Ru-103
Sb-125, Y-88, Zn-65, Zr-95

Ambient Sediment Monitoring Data

2007 ESOP Gamma Sediment Non-Random Data
Savannah River Site Streams That Are Not Accessible to the Public:

Sample ID	SMSV-2027	SMSV-2069	SMSV-2073	SMSV-324
Collection Date	3/21/2007	3/21/2007	3/21/2007	3/21/2007
Analyte and Results	pCi/g	pCi/g	pCi/g	pCi/g
K-40	<MDA	**4.071**	**1.529**	<MDA
Confidence Interval (±2 SD)		**0.7064**	**0.5193**	
MDA	0.3569	**0.4717**	**0.5052**	0.3385
Mn-54	<MDA	**0.1076***	**0.0775***	<MDA
Confidence Interval (±2 SD)		**0.0444***	**0.0299***	
MDA	0.0434	**0.0689***	**0.0683***	0.0398
Cs-137	<MDA	**0.3384**	<MDA	<MDA
Confidence Interval (±2 SD)		**0.0492**		
MDA	0.0360	**0.0628**	0.0578	0.0398
Eu-155	<MDA	<MDA	<MDA	**0.7528***
Confidence Interval (±2 SD)				**0.1074***
MDA	0.0990	0.2225	0.2093	**0.1131***
Pb-212	**2.299**	**2.301**	<MDA	**2.628**
Confidence Interval (±2 SD)	**0.2100**	**0.2214**		**0.2395**
MDA	**0.0495**	**0.0830**	0.0807	**0.0563**
Pb-214	**1.112**	**3.615**	**4.810**	**1.501**
Confidence Interval (±2 SD)	**0.0760**	**0.2064**	**0.2328**	**0.0930**
MDA	**0.0683**	**0.1250**	**0.1220**	**0.0769**
Ra-226	**2.287**	**7.618**	**9.687**	**3.007**
Confidence Interval (±2 SD)	**0.6708**	**1.369**	**1.278**	**0.7421**
MDA	**0.8246**	**1.393**	**1.406**	**0.9292**
Ac-228	**2.127**	**2.403**	**2.555**	**2.729**
Confidence Interval (±2 SD)	**0.1299**	**0.2211**	**0.2088**	**0.1505**
MDA	**0.1144**	**0.2189**	**0.2070**	**0.1124**
Th-234	<MDA	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)				
MDA	0.5382	0.8463	0.8299	0.5583

*** Results for Eu-155 and Mn-54 may be a false positive due to interference with Ac-228.**

Note: There were no detections for:
Am-241, Be-7, Ce-144, Co-58, Co-60, Cs-134, Eu-152, Eu-154, I-131, Na-22, Ru-103
Sb-125, Y-88, Zn-65, Zr-95

Ambient Sediment Monitoring Data

2007 ESOP Gamma Sediment Non-Random Data
Savannah River Site Streams That Are Not Accessible to the Public:

Sample ID	SMSV-325	SMSV-2049	SMSV-2039	SMSV-2048
Collection Date	3/22/2007	3/22/2007	3/22/2007	3/22/2007
Analyte and Results	pCi/g	pCi/g	pCi/g	pCi/g
K-40	<MDA	**1.262**	<MDA	**1.392**
Confidence Interval (±2 SD)		**0.2398**		**0.4588**
MDA	0.3546	**0.1569**	0.1362	**0.4321**
Mn-54	<MDA	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)				
MDA	0.0550	0.0314	0.022	0.0795
Cs-137	**0.0797**	**0.3238**	**0.2312**	**0.1026**
Confidence Interval (±2 SD)	**0.0302**	**0.0378**	**0.0291**	**0.0431**
MDA	**0.0420**	**0.0259**	**0.0186**	**0.0631**
Eu-155	<MDA	<MDA	<MDA	**1.262***
Confidence Interval (±2 SD)				**0.1502***
MDA	0.1106	0.0810	0.0502	**0.1749***
Pb-212	<MDA	**0.6152**	<MDA	**10.13**
Confidence Interval (±2 SD)		**0.0647**		**0.8949**
MDA	0.0592	**0.0319**	0.0197	**0.0858**
Pb-214	**2.738**	**0.4092**	**0.1666**	**2.778**
Confidence Interval (±2 SD)	**0.1407**	**0.0403**	**0.0273**	**0.1637**
MDA	**0.0893**	**0.0508**	**0.0385**	**0.1202**
Ra-226	**5.189**	**1.262**	<MDA	**5.744**
Confidence Interval (±2 SD)	**0.9585**	**0.4491**		**1.114**
MDA	**1.031**	**0.5601**	0.3923	**1.430**
Ac-228	**1.480**	**0.6624**	<MDA	**5.070**
Confidence Interval (±2 SD)	**0.1492**	**0.0683**		**0.2603**
MDA	**0.1485**	**0.0893**	0.0900	**0.1819**
Th-234	<MDA	**0.4487**	<MDA	<MDA
Confidence Interval (±2 SD)		**0.1788**		
MDA	0.6074	**0.3511**	0.2834	0.8639

*** Results for Eu-155 and Mn-54 may be a false positive due to interference with Ac-228.**

Note: There were no detections for:
Am-241, Be-7, Ce-144, Co-58, Co-60, Cs-134, Eu-152, Eu-154, I-131, Na-22, Ru-103
Sb-125, Y-88, Zn-65, Zr-95

Ambient Sediment Monitoring Data

2007 ESOP Gamma Sediment Non-Random Data
Savannah River Site Storm Water Basins That Are Not Accessible to the Public:

Sample ID	SME-001	SME-002	SME-003	SME-004
Collection Date	3/12/2007	3/12/2007	3/12/2007	3/12/2007
Analyte and Results	pCi/g	pCi/g	pCi/g	pCi/g
K-40	**0.4001**	**0.9760**	<MDA	**3.295**
Confidence Interval (±2 SD)	**0.1955**	**0.4183**		**0.4489**
MDA	**0.2062**	**0.4066**	0.2229	**0.2674**
Cs-137	**0.0947**	**0.1543**	**0.1409**	<MDA
Confidence Interval (±2 SD)	**0.0189**	**0.0353**	**0.0329**	
MDA	**0.0270**	**0.0493**	**0.0284**	0.0384
Eu-155	<MDA	**0.7374***	<MDA	<MDA
Confidence Interval (±2 SD)		**0.1441***		
MDA	0.0858	**0.1507***	0.0894	0.1002
Pb-212	<MDA	**1.555**	<MDA	**1.689**
Confidence Interval (±2 SD)		**0.1545**		**0.1598**
MDA	0.0351	**0.0624**	0.0341	**0.0493**
Pb-214	**0.4824**	**1.884**	**0.6404**	**0.9279**
Confidence Interval (±2 SD)	**0.0565**	**0.1117**	**0.0515**	**0.0700**
MDA	**0.0510**	**0.0952**	**0.0562**	**0.0714**
Ra-226	**1.530**	**4.504**	**1.249**	**2.457**
Confidence Interval (±2 SD)	**0.4640**	**0.9791**	**0.4240**	**0.7203**
MDA	**0.5916**	**1.080**	**0.6070**	**0.8438**
Ac-228	**0.7742**	**1.534**	**0.6531**	**1.796**
Confidence Interval (±2 SD)	**0.0917**	**0.1412**	**0.0763**	**0.1802**
MDA	**0.0880**	**0.1688**	**0.1039**	**0.1270**

*** Results for Eu-155 and Mn-54 may be a false positive due to interference with Ac-228.**

Note: There were no detections for:
Am-241, Be-7, Ce-144, Co-58, Co-60, Cs-134, Eu-152, Eu-154, I-131, Mn-54, Na-22, Ru-103
Sb-125, Th-234, Y-88, Zn-65, Zr-95

Ambient Sediment Monitoring Data

2007 ESOP Gamma Sediment Non-Random Data
Savannah River Site Storm Water Basins That Are Not Accessible to the Public:

Sample ID	SME-005	SME-006	SMZ-BASIN
Collection Date	3/12/2007	3/12/2007	3/12/2007
Analyte and Results	pCi/g	pCi/g	pCi/g
K-40	<MDA	**3.316**	**1.087**
Confidence Interval (±2 SD)		**0.4224**	**0.3178**
MDA	0.1975	**0.2638**	**0.2395**
Cs-137	<MDA	<MDA	**1.369**
Confidence Interval (±2 SD)			**0.1063**
MDA	0.0277	0.0400	**0.0313**
Eu-155	<MDA	**0.5074***	<MDA
Confidence Interval (±2 SD)		**0.0778***	
MDA	0.0759	**0.0923***	0.0860
Pb-212	**0.3731**	**1.760**	<MDA
Confidence Interval (±2 SD)	**0.0457**	**0.1643**	
MDA	**0.0296**	**0.0466**	0.0436
Pb-214	**0.4881**	**1.048**	**0.7436**
Confidence Interval (±2 SD)	**0.0510**	**0.0754**	**0.0757**
MDA	**0.0501**	**0.0722**	**0.0775**
Ra-226	<MDA	**2.229**	**2.054**
Confidence Interval (±2 SD)		**0.6643**	**0.6488**
MDA	0.5201	**0.7954**	**0.7993**
Ac-228	<MDA	**1.551**	**0.8883**
Confidence Interval (±2 SD)		**0.1401**	**0.1088**
MDA	0.1550	**0.1171**	**0.0978**

*** Results for Eu-155 and Mn-54 may be a false positive due to interference with Ac-228.**

Note: There were no detections for:
Am-241, Be-7, Ce-144, Co-58, Co-60, Cs-134, Eu-152, Eu-154, I-131, Mn-54, Na-22, Ru-103
Sb-125, Th-234, Y-88, Zn-65, Zr-95

Ambient Sediment Monitoring Data

2007 ESOP Gamma Sediment Data **SRS Random Perimeter "E" Samples <50 Miles**

Sample ID	SME1	SME2	SME3	SME4	SME5
Collection Date	3/19/2007	3/19/2007	3/19/2007	5/29/2007	3/19/2007
Analyte and Results	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
K-40	**5.615**	**1.409**	**3.532**	**1.659**	**2.361**
Confidence Interval (±2 SD)	**0.6338**	**0.2667**	**0.4633**	**0.1989**	**0.4087**
MDA	**0.3924**	**0.2396**	**0.2570**	**0.1050**	**0.2809**
Mn-54	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)					
MDA	0.0521	0.0409	0.0421	0.0165	0.0466
Cs-137	**0.2794**	<MDA	<MDA	<MDA	**0.1256**
Confidence Interval (±2 SD)	**0.0388**				**0.0346**
MDA	**0.0506**	0.0342	0.0386	0.0136	**0.0387**
Eu-155	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)					
MDA	0.1772	0.1151	0.0903	0.0797	0.1361
Pb-212	**2.608**	**1.169**	**1.430**	**1.027**	**1.842**
Confidence Interval (±2 SD)	**0.2418**	**0.1148**	**0.1357**	**0.0906**	**0.1728**
MDA	**0.0657**	**0.0370**	**0.0397**	**0.0292**	**0.0531**
Pb-214	**1.725**	**0.7525**	**1.041**	**0.7891**	**1.167**
Confidence Interval (±2 SD)	**0.1126**	**0.0583**	**0.0690**	**0.0505**	**0.0792**
MDA	**0.0999**	**0.0670**	**0.0672**	**0.0305**	**0.0775**
Ra-226	**5.098**	**1.444**	**2.040**	**1.665**	**2.864**
Confidence Interval (±2 SD)	**1.089**	**0.7078**	**0.6669**	**0.3893**	**0.7245**
MDA	**1.094**	**0.7536**	**0.7662**	**0.3823**	**0.8638**
Ac-228	**2.5500**	**1.1270**	**1.3580**	**1.0240**	**1.7540**
Confidence Interval (±2 SD)	**0.1998**	**0.0969**	**0.1307**	**0.0647**	**0.1218**
MDA	**0.1617**	**0.1095**	**0.1103**	**0.0455**	**0.1320**
Th-234	<MDA	<MDA	**3.7040**	<MDA	<MDA
Confidence Interval (±2 SD)			**1.7480**		
MDA	0.6766	0.6173	**0.4885**	0.3398	0.5501
Am-241	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)					
MDA	0.1599	0.0894	0.0939	0.1617	0.1256

In "E" Samples, there were no detects for:
Am-241, Be-7, Ce-144, Co-58, Co-60, Cs-134, Eu-152, Eu-154, I-131, Na-22, Ru-103, Sb-125, Y-88, Zn-65, Zr

Ambient Sediment Monitoring Data

2007 ESOP Gamma Sediment Data **SRS Random Perimeter "E" Samples <50 Miles**

Sample ID	SME6	SME7	SME8	SME9	SME10
Collection Date	5/29/2007	10/11/2007	6/21/2007	5/29/2007	6/21/2007
Analyte and Results	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
K-40	**1.686**	**1.527**	<MDA	**3.819**	**0.2861**
Confidence Interval (±2 SD)	**0.1953**	**0.2262**		**0.3249**	**0.1276**
MDA	**0.0848**	**0.0983**	0.0993	**0.0871**	**0.0999**
Mn-54	<MDA	<MDA	<MDA	<MDA	**0.0196***
Confidence Interval (±2 SD)					**0.0089***
MDA	0.0108	0.0169	0.0137	0.0112	**0.0128***
Cs-137	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)					
MDA	0.0086	0.0135	0.0128	0.0106	0.0130
Eu-155	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)					
MDA	0.0439	0.0692	0.0697	0.0390	0.0719
Pb-212	<MDA	**0.2033**	**0.6697**	<MDA	**0.8783**
Confidence Interval (±2 SD)		**0.0225**	**0.3286**		**0.0780**
MDA	0.0186	**0.0284**	**0.0280**	0.0186	**0.0263**
Pb-214	**0.2560**	**1.399**	**0.9742**	**0.2840**	**0.7810**
Confidence Interval (±2 SD)	**0.0257**	**0.0702**	**0.0543**	**0.0232**	**0.0456**
MDA	**0.0191**	**0.0288**	**0.0280**	**0.0196**	**0.0273**
Ra-226	<MDA	**2.585**	**2.046**	**0.4979**	**1.309**
Confidence Interval (±2 SD)		**0.4379**	**0.3875**	**0.2377**	**0.3506**
MDA	0.2225	**0.3644**	**0.3627**	**0.2360**	**0.3522**
Ac-228	<MDA	**0.3209**	**0.7763**	**0.3338**	**0.8732**
Confidence Interval (±2 SD)		**0.0467**	**0.0595**	**0.0339**	**0.0598**
MDA	0.0606	**0.0479**	**0.0448**	**0.0322**	**0.0420**
Th-234	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)					
MDA	0.2782	0.7197	0.4050	0.2869	0.3036
Am-241	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)					
MDA	0.0933	0.1444	0.1513	0.0998	0.1455

*** Results for Eu-155 and Mn-54 may be a false positive due to interference with Ac-228.**

In "E" Samples, there were no detects for:
Am-241, Be-7, Ce-144, Co-58, Co-60, Cs-134, Eu-152, Eu-154, I-131, Na-22, Ru-103, Sb-125, Y-88, Zn-65, Zr

Ambient Sediment Monitoring Data

2007 ESOP Gamma Sediment Data **SRS Random Perimeter "E" Samples <50 Miles**

Sample ID	SME11	SME12	SME13	SME14	SME15
Collection Date	6/21/2007	3/5/2007	6/21/2007	7/16/2007	7/11/2007
Analyte and Results	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
K-40	**0.7456**	**11.08**	**0.4368**	<MDA	**11.98**
Confidence Interval (±2 SD)	**0.1542**	**0.9840**	**0.1220**		**0.8389**
MDA	**0.0964**	**0.2813**	**0.0893**	0.1116	**0.0931**
Mn-54	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)					
MDA	0.0132	0.0594	0.0129	0.0226	0.0124
Cs-137	<MDA	**0.2086**	**0.0217**	<MDA	<MDA
Confidence Interval (±2 SD)		**0.0378**	**0.0081**		
MDA	0.0140	**0.0457**	**0.0112**	0.0149	0.0117
Eu-155	**0.3300***	<MDA	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)	**0.0688***				
MDA	**0.0650***	0.1442	0.0601	0.0784	0.0536
Pb-212	**1.204**	**1.613**	**0.7000**	**0.8838**	<MDA
Confidence Interval (±2 SD)	**0.1036**	**0.7499**	**0.0632**	**0.3537**	
MDA	**0.0277**	**0.0564**	**0.0222**	**0.0297**	0.0210
Pb-214	**0.7525**	**1.358**	**0.4815**	**1.265**	**0.2408**
Confidence Interval (±2 SD)	**0.0491**	**0.0930**	**0.0363**	**0.0628**	**0.0256**
MDA	**0.0282**	**0.0863**	**0.0232**	**0.0316**	**0.0217**
Ra-226	**1.686**	**3.593**	**0.9642**	**1.717**	**0.7825**
Confidence Interval (±2 SD)	**0.4045**	**0.9174**	**0.3004**	**0.4104**	**0.3245**
MDA	**0.3718**	**0.9372**	**0.3055**	**0.3780**	**0.2543**
Ac-228	**1.204**	**1.214**	**0.7232**	**0.8045**	**0.3736**
Confidence Interval (±2 SD)	**0.0739**	**0.1388**	**0.0515**	**0.0610**	**0.0396**
MDA	**0.0447**	**0.1603**	**0.3796**	**0.0498**	**0.0425**
Th-234	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)					
MDA	0.3412	0.7830	0.3598	0.8004	0.2922
Am-241	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)					
MDA	0.1575	0.1321	0.1220	0.1542	0.1060

*** Results for Eu-155 and Mn-54 may be a false positive due to interference with Ac-228.**

In "E" Samples, there were no detects for:
Am-241, Be-7, Ce-144, Co-58, Co-60, Cs-134, Eu-152, Eu-154, I-131, Na-22, Ru-103, Sb-125, Y-88, Zn-65, Zr

Ambient Sediment Monitoring Data

2007 ESOP Gamma Sediment Data **SRS Random Perimeter "E" Samples <50 Miles**

Sample ID	SME16	SME17	SME18	SME19	SME20
Collection Date	6/15/2007	12/14/2007	6/15/2007	7/16/2007	9/19/2007
Analyte and Results	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
K-40	**0.5468**	**1.040**	**0.2877**	**12.98**	**1.584**
Confidence Interval (±2 SD)	**0.1480**	**0.4957**	**0.1281**	**1.018**	**0.2597**
MDA	**0.0991**	**0.3230**	**0.1012**	**0.2227**	**0.1509**
Mn-54	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)					
MDA	0.0133	0.0470	0.0121	0.0390	0.0249
Cs-137	**0.0358**	<MDA	<MDA	**0.0696**	**0.0627**
Confidence Interval (±2 SD)	**0.0098**			**0.0266**	**0.0177**
MDA	**0.0111**	0.0395	0.0138	**0.0260**	**0.0186**
Eu-155	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)					
MDA	0.0592	0.1717	0.0731	0.1086	0.0942
Pb-212	**0.6711**	**1.999**	**1.109**	**1.187**	<MDA
Confidence Interval (±2 SD)	**0.0618**	**0.9635**	**0.0967**	**0.5847**	
MDA	**0.0243**	**0.0660**	**0.0274**	**0.0486**	0.0387
Pb-214	**0.5660**	**1.397**	**0.6709**	**1.512**	**1.740**
Confidence Interval (±2 SD)	**0.0366**	**0.1160**	**0.0452**	**0.0981**	**0.0903**
MDA	**0.0252**	**0.0755**	**0.0276**	**0.0508**	**0.0405**
Ra-226	**1.121**	**2.907**	**1.334**	**3.254**	**2.826**
Confidence Interval (±2 SD)	**0.3300**	**0.8805**	**0.4484**	**0.7725**	**0.5945**
MDA	**0.3054**	**0.8439**	**0.3577**	**0.6043**	**0.4934**
Ac-228	**0.6984**	**1.828**	**1.128**	**1.232**	**0.5368**
Confidence Interval (±2 SD)	**0.0508**	**0.1462**	**0.0675**	**0.1017**	**0.0657**
MDA	**0.0393**	**0.1242**	**0.0438**	**0.0897**	**0.0658**
Th-234	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)					
MDA	0.2832	2.151	0.4279	1.059	1.036
Am-241	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)					
MDA	0.1270	0.6757	0.1554	0.2498	0.2030

In "E" Samples, there were no detects for:
Am-241, Be-7, Ce-144, Co-58, Co-60, Cs-134, Eu-152, Eu-154, I-131, Na-22, Ru-103, Sb-125, Y-88, Zn-65, Zr

Ambient Sediment Monitoring Data

2007 ESOP Gamma Sediment Data **SRS Random Perimeter "E" Samples <50 Miles**

Sample ID	SME21	SME22	SME24	SME25	SME26
Collection Date	10/12/2007	7/13/2007	9/19/2007	7/11/2007	7/11/2007
Analyte and Results	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
K-40	<MDA	**0.4023**	**0.4721**	**24.90**	**10.11**
Confidence Interval (±2 SD)		**0.1598**	**0.1885**	**1.663**	**0.7639**
MDA	0.3155	**0.0977**	**0.1491**	**0.1187**	**0.1460**
Mn-54	<MDA	<MDA	**0.0772***	<MDA	<MDA
Confidence Interval (±2 SD)			**0.0241***		
MDA	0.0502	0.0176	**0.0225***	0.0168	0.0155
Cs-137	<MDA	**0.0380**	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)		**0.0137**			
MDA	0.0397	**0.0109**	0.0214	0.0151	0.0155
Eu-155	<MDA	<MDA	**0.8493***	<MDA	<MDA
Confidence Interval (±2 SD)			**0.1223***		
MDA	0.1947	0.0559	**0.1064***	0.0697	0.0801
Pb-212	**2.155**	<MDA	**3.387**	**0.6292**	**0.8599**
Confidence Interval (±2 SD)	**0.8718**		**0.2805**	**0.0592**	**0.3537**
MDA	**0.0675**	0.0222	**0.0444**	**0.0267**	**0.0306**
Pb-214	**1.109**	**0.4140**	**1.752**	**0.3247**	**0.6860**
Confidence Interval (±2 SD)	**0.0990**	**0.0338**	**0.0986**	**0.0354**	**0.0522**
MDA	**0.0740**	**0.0228**	**0.0434**	**0.0287**	**0.0330**
Ra-226	**2.710**	**0.6530**	**3.221**	<MDA	**1.791**
Confidence Interval (±2 SD)	**0.7272**	**0.3137**	**0.5215**		**0.5439**
MDA	**0.8352**	**0.2735**	**0.5876**	0.3501	**0.3885**
Ac-228	**2.187**	**0.3412**	**3.597**	**0.6062**	**0.7861**
Confidence Interval (±2 SD)	**0.1513**	**0.0406**	**0.1605**	**0.0553**	**0.0625**
MDA	**0.1102**	**0.0364**	**0.0626**	**0.0537**	**0.0561**
Th-234	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)					
MDA	1.647	0.4823	1.064	0.3917	0.4792
Am-241	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)					
MDA	0.6688	0.1154	0.2507	0.1433	0.1658

*** Results for Eu-155 and Mn-54 may be a false positive due to interference with Ac-228.**

In "E" Samples, there were no detects for:
Am-241, Be-7, Ce-144, Co-58, Co-60, Cs-134, Eu-152, Eu-154, I-131, Na-22, Ru-103, Sb-125, Y-88, Zn-65, Zr

Ambient Sediment Monitoring Data

2007 ESOP Gamma Sediment Data **SRS Random Perimeter "E" Samples <50 Miles**

Sample ID	SME27	SME28
Collection Date	10/11/2007	9/19/2007
Analyte and Results	pCi/g	pCi/g
K-40	**14.96**	**0.4690**
Confidence Interval (±2 SD)	**1.053**	**0.1212**
MDA	**0.1198**	**0.1074**
Mn-54	<MDA	<MDA
Confidence Interval (±2 SD)		
MDA	0.0210	0.0175
Cs-137	<MDA	<MDA
Confidence Interval (±2 SD)		
MDA	0.0152	0.0132
Eu-155	<MDA	**0.3635***
Confidence Interval (±2 SD)		**0.0675***
MDA	0.0793	**0.0676***
Pb-212	<MDA	**1.269**
Confidence Interval (±2 SD)		**0.1088**
MDA	0.0314	**0.0279**
Pb-214	**0.5962**	**0.9489**
Confidence Interval (±2 SD)	**0.0433**	**0.0549**
MDA	**0.0323**	**0.0278**
Ra-226	**1.236**	**1.527**
Confidence Interval (±2 SD)	**0.3479**	**0.3831**
MDA	**0.3860**	**0.3789**
Ac-228	**0.7964**	**1.287**
Confidence Interval (±2 SD)	**0.0640**	**0.0739**
MDA	**0.0558**	**0.0390**
Th-234	<MDA	<MDA
Confidence Interval (±2 SD)		
MDA	0.8829	0.8731
Am-241	<MDA	<MDA
Confidence Interval (±2 SD)		
MDA	0.1639	0.1589

*** Results for Eu-155 and Mn-54 may be a false positive due to interference with Ac-228.**

In "E" Samples, there were no detects for:
Am-241, Be-7, Ce-144, Co-58, Co-60, Cs-134, Eu-152, Eu-154, I-131, Na-22, Ru-103, Sb-125, Y-88, Zn-65, Zr

Ambient Sediment Monitoring Data

2007 ESOP Gamma Sediment Data **SRS Random Perimeter "B" Samples >50 Miles**

Sample ID	SMB2	SMB3	SMB4	SMB5	SMB6
Collection Date	3/19/2007	11/20/2007	5/25/2007	12/21/2007	3/5/2007
Analyte and Results	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
K-40	**0.3941**	**0.9150**	**5.927**	**34.18**	**9.168**
Confidence Interval (±2 SD)	**0.1558**	**0.4285**	**0.5071**	**2.497**	**0.7324**
MDA	**0.1575**	**0.2608**	**0.1273**	**0.2498**	**0.2695**
Mn-54	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)					
MDA	0.0233	0.0381	0.0182	0.0444	0.0422
Cs-137	<MDA	<MDA	**0.0319**	<MDA	<MDA
Confidence Interval (±2 SD)			**0.0133**		
MDA	0.0210	0.0315	**0.0164**	0.0390	0.0387
Eu-155	<MDA	<MDA	<MDA	<MDA	**0.1674***
Confidence Interval (±2 SD)					**0.0477***
MDA	0.0511	0.1414	0.0795	0.1664	**0.1000***
Pb-212	**0.1301**	**0.6209**	**0.8431**	**0.6880**	**2.551**
Confidence Interval (±2 SD)	**0.0180**	**0.0759**	**0.3689**	**0.0819**	**0.2308**
MDA	**0.0199**	**0.0533**	**0.0289**	**0.0599**	**0.0524**
Pb-214	**0.1816**	**0.5950**	**0.5977**	**0.4967**	**1.836**
Confidence Interval (±2 SD)	**0.0335**	**0.0733**	**0.0478**	**0.0705**	**0.1042**
MDA	**0.0354**	**0.0631**	**0.0330**	**0.0710**	**0.0736**
Ra-226	<MDA	<MDA	**1.403**	<MDA	**3.914**
Confidence Interval (±2 SD)			**0.4009**		**0.7238**
MDA	0.4184	0.6843	**0.3835**	0.8779	**0.8681**
Ac-228	<MDA	**0.6195**	**0.8414**	<MDA	**2.360**
Confidence Interval (±2 SD)		**0.0979**	**0.0651**		**0.1597**
MDA	0.1048	**0.1032**	**0.0554**	0.2562	**0.1191**
Th-234	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)					
MDA	0.2242	1.765	0.3492	1.918	0.5491
Am-241	<MDA	<MDA	<MDA	<MDA	**0.2469**
Confidence Interval (±2 SD)					**0.1079**
MDA	0.0516	0.5011	0.1650	0.6166	**0.1036**

*** Results for Eu-155 and Mn-54 may be a false positive due to interference with Ac-228.**

In "B" Samples, there were no detects for:
Be-7, Ce-144, Co-58, Co-60, Cs-134, Eu-152, Eu-154, I-131, Mn-54, Na-22, Ru-103, Sb-125, Th-234,Y-88, Zn-6

Ambient Sediment Monitoring Data

2007 ESOP Gamma Sediment Data **SRS Random Perimeter "B" Samples >50 Miles**

Sample ID	SMB7	SMB8	SMB9	SMB10	SMB11	SMB12
Collection Date	12/21/2007	12/13/2007	10/12/2007	10/12/2007	12/11/2007	12/6/2007
Analyte and Results	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
K-40	**41.64**	**1.266**	**9.056**	**5.081**	**1.483**	**1.261**
Confidence Interval (±2 SD)	**2.941**	**0.4151**	**0.9258**	**0.6997**	**0.4142**	**0.4913**
MDA	**0.2781**	**0.2262**	**0.2718**	**0.2914**	**0.2089**	**0.2461**
Mn-54	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)						
MDA	0.0455	0.0338	0.0453	0.0524	0.0295	0.0360
Cs-137	<MDA	<MDA	**0.5212**	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)			**0.0642**			
MDA	0.0399	0.0339	**0.0359**	0.0400	0.0272	0.0364
Eu-155	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)						
MDA	0.1633	0.1397	0.1797	0.1933	0.1257	0.1723
Pb-212	**0.4940**	**0.3887**	<MDA	**1.966**	**0.0911**	<MDA
Confidence Interval (±2 SD)	**0.0716**	**0.0594**		**0.1839**	**0.0420**	
MDA	**0.0617**	**0.0528**	0.0649	**0.0729**	**0.0513**	0.0624
Pb-214	**0.7376**	**0.3915**	**1.086**	**1.997**	**0.1700**	**0.8852**
Confidence Interval (±2 SD)	**0.0787**	**0.0698**	**0.0878**	**0.1311**	**0.0500**	**0.0840**
MDA	**0.0723**	**0.0570**	**0.0720**	**0.0792**	**0.0534**	**0.0683**
Ra-226	**1.667**	<MDA	**2.161**	**3.377**	<MDA	<MDA
Confidence Interval (±2 SD)	**0.8279**		**0.6896**	**0.8933**		
MDA	**0.7438**	0.7824	**0.7402**	**0.9066**	0.0667	0.7812
Ac-228	<MDA	<MDA	**1.084**	**2.036**	<MDA	**1.379**
Confidence Interval (±2 SD)			**0.1315**	**0.1533**		**0.1259**
MDA	0.2323	0.1756	**0.1189**	**0.1300**	0.1389	**0.1121**
Th-234	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)						
MDA	1.962	1.557	2.061	2.390	1.509	2.094
Am-241	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (±2 SD)						
MDA	0.5750	0.4848	0.6045	0.7327	0.4413	0.6105

In "B" Samples, there were no detects for:
Be-7, Ce-144, Co-58, Co-60, Cs-134, Eu-152, Eu-154, I-131, Mn-54, Na-22, Ru-103, Sb-125, Th-234,Y-88, Zn-6

Ambient Sediment Monitoring Data

2007 ESOP Organic and Inorganic Analysis of SRS Stream Sediments

Sample Location:	SMSV-2027	SMSV-2069	SMSV-2073	SMSV-324	SMSV-325	SMSV-2049	SMSV-2039
Sample Date:	3/21/2007	3/21/2007	3/21/2007	3/21/2007	3/22/2007	3/22/2007	3/22/2007
Inorganic Analysis (mg/kg)							
Aluminum in Sediment	**2200**	**6600**	**14000**	**580**	**1600**	**490**	**280**
Cobalt in Sediment	<2.0	**4.3**	**17**	<2.0	**2.3**	<2.0	<2.0
Chromium in Sediment	**3.3**	**9.8**	**23**	**1.8**	**2.8**	**1.2**	**1.8**
Copper in Sediment	**2.0**	**3.3**	**69**	<1.0	<1.0	**2.4**	<1.0
Iron in Sediment	**690**	**5300**	**17000**	**610**	**580**	**1600**	**790**
Magnesium in Sediment	**96**	**250**	**570**	**23**	**72**	**110**	**16**
Manganese in Sediment	**7.8**	**46**	**730**	**88**	**14**	**65**	**60**
Nickel in Sediment	**3.8**	**4.6**	**17**	<2.0	**2.4**	<2.0	<2.0
Lead in Sediment	**6.6**	**12**	**26**	<5.0	<5.0	<5.0	<5.0
Zinc in Sediment	**10**	**100**	**93**	<1.0	**12**	**8.4**	**3.7**
Organic Analysis (mg/kg)							
4-methylphenol	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Benzo(a)pyrene	<0.30	<0.30	<0.30	<0.30	**0.37**	<0.30	<0.30
Benzo(ghi)perylene	<0.30	<0.30	<0.30	<0.30	**0.30**	<0.30	<0.30
Dibenzo(a,h)anthracene	<0.30	<0.30	<0.30	<0.30	**0.42**	<0.30	<0.30
Di-n-octylphthalate	<0.30	<0.30	<0.30	<0.30	**0.42**	<0.30	<0.30
Indeno(1,2,3-cd)pyrene	<0.30	<0.30	<0.30	<0.30	**0.40**	<0.30	<0.30

Sample Location:	SMSV-2048	SMSV-2011	SMSV-2013	SMSV-2015	SMSV-2017	SMSV-2020
Sample Date:	3/22/2007	3/28/2007	3/28/2007	3/28/2007	3/28/2007	3/28/2007
Inorganic Analysis (mg/kg)						
Aluminum in Sediment	**15000**	**6400**	**6100**	**5200**	**7700**	**9500**
Cobalt in Sediment	**12**	**8.7**	**7.1**	**8.0**	**9.0**	**7.8**
Chromium in Sediment	**23**	**12**	**9.9**	**10**	**13**	**12**
Copper in Sediment	**9.2**	**8.4**	**6.0**	**6.2**	**8.8**	**6.4**
Iron in Sediment	**9000**	**9400**	**8200**	**9300**	**12000**	**9400**
Magnesium in Sediment	**340**	**1500**	**1100**	**1100**	**1500**	**1200**
Manganese in Sediment	**760**	**1500**	**900**	**830**	**710**	**610**
Nickel in Sediment	**7.1**	**5.4**	**5.2**	**4.2**	**5.8**	**5.9**
Lead in Sediment	**29**	**9.6**	**10**	**11**	**16**	**15**
Zinc in Sediment	**59**	**34**	**27**	**31**	**34**	**32**
Organic Analysis (mg/kg)						
4-methylphenol	<0.30	**0.42**	<0.30	<0.30	<0.30	<0.30
Benzo(a)pyrene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Benzo(ghi)perylene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Dibenzo(a,h)anthracene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Di-n-octylphthalate	**0.43**	<0.30	<0.30	<0.30	<0.30	<0.30
Indeno(1,2,3-cd)pyrene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30

Ambient Sediment Monitoring Data
2007 ESOP Metals Analysis of Sediment **Random Perimeter Samples (<50 miles)**

Sample Location:	SME1	SME2	SME3	SME4	SME5	SME6
Collection Date	3/19/2007	3/19/2007	3/19/2007	5/29/2007	3/19/2007	5/29/2007
Analyte and Results	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	1100	6400	1800	480	560	350
Barium	5.4	49	18	<5.0	<5.0	<5.0
Beryllium	0.70	0.32	<0.30	0.43	0.48	<0.30
Cadmium	<1.0	2.2	<1.0	<1.0	<1.0	<1.0
Cobalt	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Chromium	<1.0	26	3.2	3.9	<1.0	4.6
Copper	<1.0	13	1.6	<1.0	<1.0	<1.0
Iron	270	3000	1000	280	200	380
Mercury	<0.10	0.20	<0.10	<0.10	<0.10	<0.10
Magnesium	53	130	46	8.0	20	6.8
Manganese	4.6	140	17	7.8	8.4	8.4
Molybdenum	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel	<2.0	4.1	3.5	<2.0	<2.0	<2.0
Lead	<5.0	16	7.3	<5.0	<5.0	<5.0
Titanium	53	69	51	160	46	9.4
Vanadium	3.9	2.7	<2.0	3.5	3.6	<2.0
Zinc	3.1	29.0	<1.0	<1.0	<1.0	<1.0

Sample Location:	SME7	SME8	SME9	SME10	SME11	SME12
Collection Date	10/11/2007	6/21/2007	5/29/2007	6/21/2007	6/21/2007	3/5/2007
Analyte and Results	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	1100	1400	1000	1500	5800	21000
Barium	17	7.3	<5.0	7.3	18	320
Beryllium	<0.30	<0.30	0.65	<0.30	<0.30	<0.30
Cadmium	<1.0	1.0	<1.0	<1.0	2.8	27
Cobalt	<2.0	<2.0	<2.0	<2.0	<2.0	19
Chromium	2.3	2.5	2.5	4.6	5.3	13
Copper	<1.0	<1.0	<1.0	<1.0	1.7	17
Iron	2200	910	880	710	3500	42000
Mercury	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium	60	40	140	38	150	1200
Manganese	380	5.2	18	16	12	9100
Molybdenum	<2.0	<2.0	2.3	<2.0	<2.0	<2.0
Nickel	<2.0	5.5	2.3	6.5	8.0	15
Lead	<5.0	5.6	<5.0	<5.0	8.8	12
Titanium	26	82	30	90	110	560
Vanadium	5.4	2.3	3.5	2.0	9.5	53.0
Zinc	2.4	<1.0	<1.0	2.7	5.1	38.0

There were no detections for silver, arsenic, boron, antimony, selenium, tin or thallium.

Ambient Sediment Monitoring Data
2007 ESOP Metals Analysis of Sediment **Random Perimeter Samples (<50 miles)**

Sample Location:	SME13	SME14	SME15	SME16	SME17	SME18
Collection Date	6/21/2007	7/16/2007	7/11/2007	6/15/2007	12/14/2007	6/15/2007
Analyte and Results	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	3300	850	1000	2600	1700	1500
Barium	<5.0	19	14	9.5	9.6	<5.0
Beryllium	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Cadmium	2.3	<1.0	1.6	<1.0	<1.0	<1.0
Cobalt	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Chromium	4.2	1.0	3	4.9	4.9	2.8
Copper	1.0	<1.0	1.1	1.8	<1.0	<1.0
Iron	2400	440	1600	1100	800	910
Mercury	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium	46	17	81	73	54	39
Manganese	15	9.1	130	22	34	21
Molybdenum	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel	4.9	<2.0	7.4	5.5	<2.0	9.4
Lead	<5.0	<5.0	<5.0	8.8	<5.0	<5.0
Titanium	40	78	46	57	41	54
Vanadium	5.3	<2.0	2.6	3.6	2.2	3.3
Zinc	<1.0	3.0	2.6	2.8	6.5	<1.0

Sample Location:	SME19	SME20	SME21	SME22	SME24	SME25
Collection Date	7/16/2007	9/19/2007	10/12/2007	7/13/2007	9/19/2007	7/11/2007
Analyte and Results	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	17000	1500	2500	960	390	2600
Barium	100	32	9.4	5.7	<5.0	9.8
Beryllium	0.62	<0.30	<0.30	<0.30	<0.30	<0.30
Cadmium	3.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt	6.6	<2.0	<2.0	<2.0	<2.0	<2.0
Chromium	19	1.0	5.0	<1.0	1.7	2.2
Copper	12	4.9	<1.0	<1.0	<1.0	3.9
Iron	13000	1600	1100	260	240	3800
Mercury	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium	1300	130.0	74	36	9.1	460
Manganese	250	48	75	2.5	9.2	40
Molybdenum	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel	7.4	<2.0	<2.0	<2.0	<2.0	<2.0
Lead	12	80	<5.0	<5.0	<5.0	<5.0
Titanium	510	22	140	54	160	160
Vanadium	36	2.9	7.0	<2.0	<2.0	8.6
Zinc	34	9.2	2.0	1.6	1.3	4.6

There were no detections for silver, arsenic, boron, antimony, selenium, tin or thallium.

Ambient Sediment Monitoring Data

2007 ESOP Metals Analysis of Sediment **Random Perimeter Samples (<50 miles)**

Sample Location:	SME26	SME27	SME28
Collection Date	7/11/2007	10/11/2007	9/19/2007
Analyte and Results	mg/kg	mg/kg	mg/kg
Aluminum	**30000**	**9500**	**920**
Barium	**60**	**51**	**31**
Beryllium	**0.55**	<0.30	<0.30
Cadmium	**9.2**	**2.5**	<1.0
Cobalt	**12**	**5.5**	<2.0
Chromium	**58**	**12**	**2.4**
Copper	**26**	**7.0**	<1.0
Iron	**47000**	**12000**	**370**
Mercury	<0.10	<0.10	<0.10
Magnesium	**1600**	**1700**	**22**
Manganese	**280**	**160**	**7.7**
Molybdenum	<2.0	<2.0	<2.0
Nickel	**12**	**6.0**	**2.4**
Lead	**14**	**5.7**	**5.6**
Titanium	**360**	**580**	**88**
Vanadium	**96**	**26**	<2.0
Zinc	**31**	**29**	<1.0

There were no detections for silver, arsenic, boron, antimony, selenium, tin or thallium.

Ambient Sediment Monitoring Data

2007 ESOP Metals Analysis of Sediment Random Background Samples (>50 miles)

Sample Location:	SMB2	SMB3	SMB4	SMB5	SMB6	SMB7
Collection Date	3/19/2007	11/20/2007	5/25/2007	12/21/2008	3/5/2007	12/21/2007
Analyte and Results	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	170	3100	14000	2800	12000	2700
Barium	<5.0	13	14	41	45	14
Beryllium	0.48	<0.30	<0.30	<0.30	<0.30	<0.30
Cadmium	<1.0	<1.0	7.9	<1.0	15	2.2
Cobalt	<2.0	<2.0	2.4	4.9	8.8	<2.0
Chromium	5.2	4.0	19.0	13	38.0	1.2
Copper	<1.0	<1.0	8.9	<1.0	7.0	<1.0
Iron	73	1100	9400	8100	20000	3400
Mercury	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium	9.2	80	2300	990	570	540
Manganese	3.4	33	150	190	280	100
Molybdenum	<2.0	<2.0	2.3	<2.0	<2.0	<2.0
Nickel	<2.0	<2.0	9.2	5.3	6.4	<2.0
Lead	<5.0	5.3	13	8.3	7.7	<5.0
Titanium	20	40	200	400	640	400
Vanadium	<2.0	7.2	44	16	55	11
Zinc	<1.0	6.6	26	7.0	22	5.0

Sample Location:	SMB8	SMB9	SMB10	SMB11	SMB12
Collection Date	12/13/2007	10/12/2007	10/12/2007	12/11/2007	12/6/2007
Analyte and Results	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	1900	18000	28000	350	710
Barium	6.6	100	81	<5.0	7.8
Beryllium	<0.30	<0.30	0.35	<0.30	<0.30
Cadmium	<1.0	8.6	7.2	<1.0	<1.0
Cobalt	<2.0	10	4.1	<2.0	<2.0
Chromium	3.1	14	19	<1.0	1.0
Copper	<1.0	5.0	1.0	<1.0	<1.0
Iron	1300	11000	10000	330	570
Mercury	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium	52	300	460	16	39
Manganese	3.8	200	68	1.6	66
Molybdenum	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel	<2.0	4.5	3.2	<2.0	<2.0
Lead	<5.0	22	22	<5.0	<5.0
Titanium	41	130	400	20	52
Vanadium	4.6	29	40	2.4	<2.0
Zinc	3.3	39	8.2	<1.0	9.5

There were no detections for silver, arsenic, boron, antimony, selenium, tin or thallium.

Back to List of Data Tables

2.5.5 Summary Statistics

Radiological and Nonradiological Monitoring of Sediments

Radiological Statistics **199**

Nonradiological Statistics **201**

Notes:

1. St. Deviation = Standard Deviation
2. N/A = Not Applicable
3. Min. – Minimum
3. Max. = Maximum

Back to List of Statistical Summaries

Summary Statistics (Detects Only)
2007 ESOP SRS Stream Sediment Radiological Data
Units are in picocuries per gram (pCi/g).

	Average	St. Deviation	Median	Min.	Max.
K-40	9.0160	6.6999	12.5900	1.262	4.071
Cs-137	0.6590	0.6702	0.3238	0.0797	0.3384
Pb-212	2.5608	2.9209	1.7710	2.301	10.13
Pb-214	1.8068	1.3196	1.3760	0.1666	4.81
Ra-226	3.9604	2.5624	2.8430	1.262	9.687
Ac-228	1.9335	1.1936	1.5885	0.6624	5.07
Th-234	2.2354	2.5267	2.2354	0.4487	0.4487
Alpha	N/A	N/A	N/A	N/A	N/A
Beta	18.71	6.06	17.2	12.0	28.8
Tc-99	0.345	0.072	0.323	0.255	0.465

Summary Statistics (Detects Only)
2007 ESOP SRS Storm Water Basins Sediment Radiological Data
Units are in picocuries per gram (pCi/g).

	Average	St. Deviation	Median	Min.	Max.
K-40	1.8148	1.3856	1.087	0.4001	3.316
Cs-137	0.4397	0.6200	0.1476	0.0947	1.369
Pb-212	1.3443	0.6530	1.622	0.3731	1.760
Pb-214	0.8878	0.4875	0.7436	0.4824	1.884
Ra-226	2.3372	1.1521	2.142	1.249	4.504
Ac-228	1.1994	0.4832	1.21115	0.6531	1.796
Alpha	N/A	N/A	N/A	N/A	N/A
Beta	12.52	3.91	14.6	7.59	15.8

Summary Statistics (Detects Only)
2007 ESOP Random Sediment Radiological Data
Perimeter Samples (<50 miles)

	Average	St. Deviation	Median	Min.	Max.
K-40	4.75	6.32	1.62	0.2861	24.90
Cs-137	0.11	0.09	0.07	0.0217	0.2794
Pb-212	1.31	0.75	1.17	0.2033	3.387
Pb-214	0.93	0.47	0.79	0.2408	1.752
Ra-226	2.03	1.08	1.72	0.4979	5.098
Ac-228	1.13	0.75	0.95	0.3209	3.597
Th-234	3.70	N/A	3.70	3.7040	3.7040
Am-241	N/A	N/A	N/A	N/A	N/A
Alpha	20.0	3.2	20.3	15.9	23.5
Beta	17.5	4.7	17.0	12.3	23.7

Summary Statistics (Detects Only)
2007 ESOP Random Sediment Radiological Data
Background Samples (>50 miles)

	Average	St. Deviation	Median	Min.	Max.
K-40	10.03	14.24	5.08	0.3941	41.64
Cs-137	0.28	0.35	0.28	0.0319	0.5212
Pb-212	0.86	0.84	0.62	0.0911	2.551
Pb-214	0.82	0.61	0.60	0.17	1.997
Ra-226	2.50	1.09	2.16	1.403	3.914
Ac-228	1.39	0.69	1.23	0.6195	2.360
Th-234	N/A	N/A	N/A	N/A	N/A
Am-241	0.2469	N/A	0.2469	0.2469	0.2469
Alpha	22.3	N/A	22.3	22.3	22.3
Beta	0.277	0.346	0.277	0.032	0.521

Note: Units are in picocuries per gram (pCi/g)

Summary Statistics (Detects Only)
2007 ESOP Ambient Sediment Nonradiological Statistical Data for SRS Streams

	Average	St. Deviation	Median	Min.	Max.	No. of Detects	Total Sampled
Inorganic Analysis (mg/kg)							
Aluminum in Sediment	5819.2	4891.7	6100	280	15000	13	13
Cobalt in Sediment	8.5	4.2	8	2.3	17	9	13
Chromium in Sediment	9.5	7.4	9.9	1.2	23	13	13
Copper in Sediment	12.2	20.1	6.3	2	69	10	13
Iron in Sediment	6451.5	5290.1	8200	580	17000	13	13
Magnesium in Sediment	605.9	585.8	340	16	1500	13	13
Manganese in Sediment	486.2	472.6	610	7.8	1500	13	13
Nickel in Sediment	6.1	4.0	5.3	2.4	17	10	13
Lead in Sediment	15.0	7.6	12	6.6	29	9	13
Zinc in Sediment	37.0	31.7	31.5	3.7	100	12	13
Organic Analysis (mg/kg)							
4-methylphenol	0.4	N/A	0.42	0.42	0.42	1	13
Benzo(a)pyrene	0.4	N/A	0.37	0.37	0.37	1	13
Benzo(ghi)perylene	0.3	N/A	0.3	0.3	0.3	1	13
Dibenzo(a,h)anthracene	0.4	N/A	0.42	0.42	0.42	1	13
Di-n-octylphthalate	0.4	0.0	0.4	0.42	0.43	2	13
Indeno(1,2,3-cd)pyrene	0.4	N/A	0.4	0.4	0.4	1	13

Note: Units are in milligrams per kilogram (mg/kg)

Summary Statistics (Detects Only)
2007 ESOP Surface Soil Metals Statistical Data for All Perimeter Samples (<50 Miles)

	Average	St. Deviation	Median	Min	Max	No. of Detects	Total Sampled
Aluminum	4400.37	7139.47	1500	350	30000	27	27
Barium	39.65	70.18	17.5	5.4	320	20	27
Beryllium	0.54	0.13	0.55	0.32	0.7	7	27
Cadmium	5.73	8.33	2.5	1	27	9	27
Cobalt	10.78	6.18	9.3	5.5	19	4	27
Chromium	7.92	12.24	4.05	1	58	24	27
Copper	7.58	7.90	4.4	1	26	12	27
Iron	5257.41	11765.18	1000	200	47000	27	27
Mercury	0.20	N/A	0.2	0.2	0.2	1	27
Magnesium	279.00	511.56	54	6.8	1700	27	27
Manganese	400.77	1741.29	18	2.5	9100	27	27
Molybdenum	2.30	N/A	2.3	2.3	2.3	1	27
Nickel	6.66	3.47	6	2.3	15	15	27
Lead	15.98	21.53	8.8	5.6	80	11	27
Titanium	136.16	164.69	69	9.4	580	12	27
Vanadium	13.47	22.99	3.6	2	96	21	27
Zinc	11.55	13.44	3.85	1.3	38	18	27

Note: Units are in milligrams per kilogram (mg/kg).

Summary Statistics (Detects Only)
2007 ESOP Ambient Sediment Nonradiological Statistical Data for SRS Streams

	Average	St. Deviation	Median	Min.	Max.	No. of Detects	Total Sampled
Inorganic Analysis (mg/kg)							
Aluminum in Sediment	5819.2	4891.7	6100	280	15000	13	13
Cobalt in Sediment	8.5	4.2	8	2.3	17	9	13
Chromium in Sediment	9.5	7.4	9.9	1.2	23	13	13
Copper in Sediment	12.2	20.1	6.3	2	69	10	13
Iron in Sediment	6451.5	5290.1	8200	580	17000	13	13
Magnesium in Sediment	605.9	585.8	340	16	1500	13	13
Manganese in Sediment	486.2	472.6	610	7.8	1500	13	13
Nickel in Sediment	6.1	4.0	5.3	2.4	17	10	13
Lead in Sediment	15.0	7.6	12	6.6	29	9	13
Zinc in Sediment	37.0	31.7	31.5	3.7	100	12	13
Organic Analysis (mg/kg)							
4-methylphenol	0.4	N/A	0.42	0.42	0.42	1	13
Benzo(a)pyrene	0.4	N/A	0.37	0.37	0.37	1	13
Benzo(ghi)perylene	0.3	N/A	0.3	0.3	0.3	1	13
Dibenzo(a,h)anthracene	0.4	N/A	0.42	0.42	0.42	1	13
Di-n-octylphthalate	0.4	0.0	0.4	0.42	0.43	2	13
Indeno(1,2,3-cd)pyrene	0.4	N/A	0.4	0.4	0.4	1	13

Note: Units are in milligrams per kilogram (mg/kg)

Back to List of Statistical Summaries

3.1 Surface Soil Monitoring

3.1.1 Summary

Surface soil is an important medium for which contamination by radionuclides and metals can be transported to other ecological systems. Plants absorb contaminants from soil that in turn introduce contaminants to the food chain. Radionuclides and metals in soil can leach into ground water and possibly emerge into surface water, thus exposing aquatic systems (Corey 1980). Air and water are subject to a much greater mixing than soil; and, therefore, dilution of metal load does not occur in soil as in other media. As a result, the accumulation of metals in surface soils is often more intense on both local and global scales than in the other components of the biosphere (Alloway 1995).The re-suspension and subsequent airborne contamination of materials, due to cleanup processes and prescribed burns, facilitates the movement of contaminants to areas outside of the Savannah River Site (SRS) boundary.

The South Carolina Department of Health and Environmental Control (SCDHEC) Environmental Surveillance and Oversight Program (ESOP) provides independent evaluation of Department of Energy – Savannah River (DOE-SR) environmental monitoring programs. ESOP personnel independently evaluated surface soils for gross alpha and non-volatile beta and select gamma-emitting radionuclides as well as a United States Environmental Protection Agency (USEPA) specified Target Analyte List (TAL) for metals. These soil samples were collected to determine if SRS activities might have impacted areas outside of the site boundary. The ESOP surface soil monitoring project changed in 2004 to include more random coverage of perimeter soils (those within 50 miles of SRS) and background soils (those greater than 50 miles). This sampling program was implemented to allow future probabilistic comparisons of the SRS perimeter and South Carolina background contaminant levels in soils. The United States Geological Survey (USGS) 7.5' Quadrangle Coverage for South Carolina (USDOI 1992) was used to determine the ESOP random quadrant sampling areas. Refer to Section 3.1.3, Table 1 and Map 1 for random sampling locations. ESOP initiated the random sampling system to determine if elevated levels of contaminants were attributed to SRS activities. Averages for random background (B) samples were subtracted from random perimeter (E) samples to determine SRS off-site 50-mile perimeter environmental concentrations above SC background. Perimeter and background averages were used to determine if data collected by ESOP were comparable to radiological data from DOE-SR data. Since DOE-SR does not report metals data for surface soil, no direct data comparisons could be made. Assessment of radiological and nonradiological contaminants in surface soil is necessary to detect any impact from DOE-SR operations beyond historically impacted areas.

ESOP collected 53 samples in 2007 from 12 random perimeter sites within the 50-mile radius of SRS and 12 random background sites outside of the 50-mile radius. In addition to this random sampling regime, 12 non-random samples were collected from both SRS perimeter and background locations. Nonrandom sampling locations are located on Section 3.1.2, Map 8. Riverbank soils from five publicly accessible boat landings were sampled to exemplify areas where direct contact to surface soil often occurs. Alpha-emitting radionuclides were not detected among the samples from the SRS perimeter nor the riverbank soils. However, there were detections among the random perimeter samples and the background samples. On average, those collected within 50 miles of SRS were higher than those collected greater than 50 miles. Non-

volatile beta was detected among all sample types. Highest averages were from the SRS perimeter. Those from the riverbanks and random samples from both a 50-mile radius, as well as all background samples, had similar averages. Gamma spectroscopy led to detections of the anthropogenic radionuclides cesium-137 (Cs-137) and americium-241 (Am-241). The majority of all the samples had detectable amounts of Cs-137. Those samples collected near the SRS perimeter yielded the highest concentrations of Cs-137, followed by those from the riverbanks. The average of those collected as a background sample was third highest, followed by those randomly collected within 50 miles of SRS. Americium-241 was detected in only four samples.

Data comparison of 2007 surface soil data from ESOP and DOE-SR resulted in similar findings. Both data sets report average Cs-137 levels higher within 50 miles of SRS than in background samples. Americium-241 was reported by both data sets as slightly higher within 50 miles of SRS than in the background samples. Metals could not be compared since SRS does not analyze nonradiological contaminants. ESOP data shows the only metal that on average is higher within 50 miles of SRS than in the background samples is lead. All metals analyzed were below the USEPA Preliminary Remediation Goals (PRG). Cesium-137 data has been trended since 2003. ESOP data from 2007 shows increased average levels of Cs-137 while DOE-SR reports for 2007 that Cs-137 levels have decreased from previous years.

RESULTS AND DISCUSSION

Radiological Parameter Results

Radioisotopes were detected in not only samples collected on SRS, but in background samples as well. The USEPA PRG is used as a screening tool that corresponds to certain levels of human risk in soil (USEPA 2004).

Gross alpha-emitting radionuclides were released to the air at SRS primarily from M-area, the reactor areas and the separations facilities (CDC 2006). Analyses were conducted on gross alpha-emitting radionuclides in surface soil samples collected during each quarter of 2007. There were no detections among the non-random SRS perimeter and riverbank soil samples. However, there were 2 detections among the non-random background soil samples averaging 25.4 (± 1.84) picocuries per gram (pCi/g). The samples ranged from 24.1 pCi/g to 26.7 pCi/g. The highest detection occurred in soil collected in Newberry County, South Carolina. Three random perimeter samples as well as one background sample detected alpha emitting particles. The random perimeter samples averaged 28.67 (± 9.51) pCi/g and ranged from 20.7 pCi/g to 39.2 pCi/g. The highest detection was in soil collected in quadrant E41 in Aiken County, South Carolina. The random background sample that had a detection of 18.2 pCi/g was collected from quadrant B38 in Laurens County, South Carolina.

Gross beta-emitting radionuclides were released from the separations areas on the SRS (CDC 2006). Gross non-volatile beta was detected in three SRS nonrandom perimeter samples at an average of 20.50 (± 9.39) pCi/g and ranged from 9.71 to 26.8 pCi/g. The highest detection was located at SSBWL-003 in Barnwell County, South Carolina. Five of the nonrandom background soils sampled had detections averaging 16.86 (± 7.96) pCi/g and ranged from 7.80 to 29.7 pCi/g. The highest detection was found in soil from Anderson County, South Carolina (SSAND-001). Four riverbank soil samples detected gross beta-emitting particles. At an average of 15.63 (±

2.53) pCi/g, the samples ranged from 12.2 to 18.20 pCi/g. Steel Creek Landing (SSSCL-001) yielded the highest riverbank soil detection. One random perimeter sample as well as four background samples detected gross beta emitting particles. The random perimeter sample collected from quadrant E50 in Saluda County, South Carolina had a detection of 16.1 pCi/g. The random background samples had four detections averaging 16.35 (± 3.07) pCi/g and ranged from 14.0 pCi/g to 20.7 pCi/g. The highest detection was from a sample collected in quadrant B47 in Laurens County.

When comparing gross alpha and gross non-volatile beta detections among the samples, gross alpha detections were absent in the SRS nonrandom perimeter and riverbank soil samples. Gross alpha detections were higher in the random perimeter samples collected within 50 miles of SRS than the background samples collected greater than 50 miles from SRS. Gross beta emitters were slightly greater in the SRS nonrandom perimeter samples than the riverbank, random perimeter, and random background soil samples. Figure 3 in Section 3.1.3 depicts these findings.

Cesium-137 is an artificially produced fission product. Atmospheric Cs-137 was released from the separation areas and was a key radionuclide released to water and air, mainly from F and H areas (CDC 2006). Cesium-137 was detected in nine SRS nonrandom perimeter samples at an average of 2.026 (± 5.496) pCi/g and ranged from 0.0875 to 16.68 pCi/g. The highest detection was located at SSALD-001 in Allendale County, South Carolina. Ten of the nonrandom background soils sampled had detections averaging 0.232 (± 0.188) pCi/g and ranged from 0.0892 to 0.7188 pCi/g. The highest detection was found in soil from Berkeley County, South Carolina (SSBER-001). All five riverbank soil samples had Cs-137 detects at an average of 0.633 (± 0.822) pCi/g. The samples ranged from 0.0675 pCi/g to 2.088 pCi/g. The highest detection was at Steel Creek Boat Landing (SSSCL-001). For comparison, the conservative USEPA PRG, corresponding to a one in a million (1E-06) increased cancer risk, is 23.4 pCi/g for a residential scenario (USEPA 2004). Nine random perimeter samples as well as five background samples detected Cs-137. The random perimeter samples' detections averaged 0.2121 (± 0.142) pCi/g and ranged from 0.0623 to 0.4199 pCi/g. The random background samples had detections averaging 0.415 (± 0.147) pCi/g and ranged from 0.2055 to 0.5831 pCi/g. The highest perimeter detection was from soil collected in quadrant E49 in Allendale County and the highest random background detection was from a sample collected in quadrant B47 in Laurens County. Cesium-137, on average, was highest in the SRS perimeter samples followed by the riverbank soils. These averages were followed by the background samples, which were higher than the random perimeter samples. The results are depicted in Section 3.1.3, Figure 2.

Another fission product, zirconium-95 (Zr-95), was detected in two samples. The soil collected from SSB47 in Laurens County yielded 0.894 pCi/g and a second sample from Anderson County (SSAND001) held 0.4871 pCi/g. Since this isotope has a very short half life of 64 days, it is unlikely a product of fission from SRS. Also, there were no detections of Zr-95 within 50 miles of SRS. The conservative USEPA PRG, corresponding to a 1E-06 increased cancer risk, is 3.89 pCi/g for a residential scenario (USEPA 2004).

Americium-241 (Am-241) was detected in four surface soil samples in 2007. The man-made Am-241 is a transuranic nuclide produced during the fission process. Long lived in the environment with a half-life of 432 years, this nuclide may be a legacy of past nuclear fallout

events. However, previous studies indicate that Am-241 was released in significant quantities from the SRS (Till et al. 2001). Along with Cs-137, Am-241 was released to the air from the SRS (CDC 2006). Americium-241 was detected in one SRS nonrandom perimeter sample. The surface soil collected in Aiken County (SSAIK-001) had a detection of 0.2669 pCi/g. Two of the nonrandom background soils sampled had detections averaging 0.435 (± 0.157) pCi/g ranging from 0.3239 to 0.5455 pCi/g. The highest detection was found in soil from Anderson County (SSAND-001). None of the five riverbank soil samples detected Am-241 nor did the random background samples. The highest Am-241 detection in all the surface soil samples collected in 2007 was a random perimeter sample. This sample collected from quadrant E46 in Orangeburg County, South Carolina had a detection of 0.762 pCi/g. The conservative USEPA PRG, corresponding to a 1E-06 increased cancer risk, is 1.97 pCi/g for a residential scenario (USEPA 2004). Figure 2 in Section 3.1.3 shows how the averages for Am-241 compared among the different samples.

In addition, potassium-40, lead-212, lead-214, radium-226, actinium-228, and thorium-234 were the only other gamma-emitting radionuclides detected among surface soil samples. These are Naturally Occurring Radioactive Material (NORM) decay products that may account for these detections. All other gamma-emitting radionuclides had no detections above their respective Minimum Detectable Activity (MDA).

A complete list of radioisotopes that ESOP analyzed for in 2007 can be found in Section 3.1.3, Table 2. Radiological data can be found in Section 3.1.4 and statistical data can be found in Section 3.1.5.

Non-Radiological Parameter Results

Metals were detected in many of the surface soil samples. The USEPA PRGs are used as a screening tool that corresponds to certain levels of human risk in soils (USEPA 2004). The Ecological Screening Value (ESV) for soils does not represent remediation goals or cleanup levels, but is used to identify constituents of potential concern (WSRC 2005b).

Chromium solutions were used at the SRS as corrosive inhibitors. Chromium was a part of wastewater solutions resulting from dissolving stainless steel. It was also used in cleaning solutions in the separation areas (Till et al. 2001). Disposal of fly–ash on land is a contributor of both chromium and nickel to soils (Alloway 1995). Chromium was detected in 12 SRS nonrandom perimeter samples at an average of 7.83 (± 7.55) milligrams per kilogram (mg/kg) and ranged from 2.6 to 28 mg/kg. The highest detection was located in SSALD-001 in Allendale County. Of the nonrandom background soil sampled all 12 had detections averaging 15.45 (± 8.80) mg/kg and ranged from 2 to 28 mg/kg. The highest detections of 28 mg/kg were found in soil from Berkeley and Newberry Counties (SSBER-001 and SSNEW-001). Four riverbank soil samples detected chromium. At an average of 12.93 (± 3.26) mg/kg, the samples ranged from 9.7 to 17 mg/kg. Steel Creek Landing (SSSCL-001) yielded the highest riverbank soil detection. All 12 random perimeter samples, as well as all twelve background samples, detected chromium. The random perimeter samples averaged 7.16 (± 6.06) mg/kg and ranged from 1.7 to 20 mg/kg. The highest detection was from a sample collected in quadrant E46 in Orangeburg County. The random background samples had detections averaging 11.88 (± 10.52) mg/kg and ranged from 2.3 to 32 mg/kg. The highest detection was from a sample collected in quadrant B39 in Saluda

County. For comparison, conservative USEPA PRG, corresponding to a 1E-06 increased cancer risk, are 210 mg/kg for a residential scenario and 450 mg/kg for an industrial land use scenario. While all soil samples were below the PRG, all were well over the ESV for soil of 0.4 mg/kg. Those exceeding the ESV were found in perimeter samples; however, the average for all the background samples was higher. While all samples exceeded the ESV, the SC state average for chromium in soil is 16 mg/kg (Canova 1999).

Copper, while naturally occurring, can also be released to the environment through the combustion of wood, coal and oil (Alloway 1995). These mechanisms are possible sources of elevated copper in surface soils. Copper was detected in eight SRS nonrandom perimeter samples at an average of 5.21 (± 7.22) mg/kg and ranged from 1.1 to 20 mg/kg. The highest detection was located in Allendale County (SSALD-001). Of the nonrandom background soil sampled 11 had detections averaging 11.04 (± 7.59) mg/kg and ranged from 1.5 to 24 mg/kg. The highest detection was found in soil from Berkeley County (SSBER-001). None of the riverbank soil samples detected copper above the Minimum Detection Level (MDL) of 1.0 mg/kg. Half of the random perimeter samples, as well as half the background samples, detected copper. The random perimeter samples averaged 3.00 (± 2.48) mg/kg and ranged from 1.3 to 8 mg/kg. The highest detection was from a sample collected in quadrant E41 in Aiken County. The random background samples had detections averaging 7.37 (± 5.85) mg/kg and ranged from 1.2 to 13 mg/kg. The highest detections of 13 mg/kg were from samples collected in quadrants B39 in Saluda County and B45 in Anderson County. Conservative USEPA PRG, corresponding to a chronic risk for soil ingestion, 3,100 mg/kg for a residential scenario and 41,000 mg/kg for an industrial land use scenario. All samples were below the ESV for copper (36 mg/kg).

The largest anthropogenic source of nickel globally is the burning of fuels and coal combustion (Alloway 1995). At SRS, nickel was directly released through M-area effluent from the plating rinse tanks and through site use of diesel generators (Till et al. 2001). Nickel was detected in three SRS nonrandom perimeter samples at an average of 5.97 (± 3.19) mg/kg and ranged from 2.3 to 8.1 mg/kg. The highest detection was located in Allendale County (SSALD-001). Of the nonrandom background soil sampled, nine had detections averaging 8.19 (± 2.99) mg/kg and ranged from 2.1 to 12 mg/kg. The highest detection was found in soil from Newberry County (SSNEW-001). Four riverbank soil samples had detections of nickel. At an average of 3.85 (± 0.42) mg/kg, the samples ranged from 3.3 to 4.3 mg/kg. Steel Creek Landing (SSSCL-001) yielded the highest riverbank soil detection. Three random perimeter samples, as well as four background samples, had detections of nickel. The random perimeter samples averaged 2.90 (± 0.36) mg/kg and ranged from 2.6 to 3.3 mg/kg. The highest detection was from a sample collected in quadrant E50 in Saluda County. The random background samples had detections averaging 9.70 (± 4.40) mg/kg and ranged from 3.9 to 14 mg/kg. The highest detection was from a sample collected in quadrant B45 in Anderson County. Conservative USEPA PRG, corresponding to a chronic risk for soil ingestion, are 1,600 mg/kg for a residential scenario and 20,000 mg/kg for an industrial land use scenario. All samples were below the ESV for nickel (30 mg/kg).

Atmospheric emissions of lead from SRS occurred through coal and fuel combustion (Till et al. 2001). Depositions of lead in soil have a long residence time compared to other pollutants. Lead tends to accumulate in soil where its bioavailability can exist far into the future (Alloway 1995).

Lead was detected in five SRS nonrandom perimeter samples at an average of 15.72 (± 11.60) mg/kg and ranged from 6.6 to 36 mg/kg. The highest detection was located at SSALD-001 in Allendale County. Of the nonrandom background soil sampled eleven had detections averaging 14.30 (± 9.97) mg/kg and ranged from 6.7 to 42 mg/kg. The highest detections were found in soil from Berkeley County (SSBER-001). Four riverbank soil samples detected lead. At an average of 17.25 (± 7.41) mg/kg, the samples ranged from 11 to 28 mg/kg. The Highway 301 bridge area (SS301SC-001) yielded the highest riverbank soil detection for lead. Seven random perimeter samples, as well as seven background samples, had lead detections. The random perimeter samples averaged 17.54 (± 14.58) mg/kg and ranged from 5.3 to 40 mg/kg. The highest detection was from a sample collected in quadrant E41 in Aiken County. The random background samples had detections averaging 14.84 (± 7.88) mg/kg and ranged from 6.5 to 27 mg/kg. The highest detection was from a sample collected in quadrant B47 in Laurens County. For comparison, conservative USEPA PRG, corresponding to a chronic risk, are 6,100 mg/kg for a residential scenario and 620 mg/kg for an industrial land use scenario. The average of all the riverbank soil and random perimeter soil exceeded the ESV; averages for the SRS perimeter soil, as well as background soil, were below the ESV of 16 mg/kg.

Zinc was released in relatively small amounts to the separations area seepage basins as well as the M-area seepage basin (Till et al. 2001). Zinc was detected in all 12 SRS nonrandom perimeter samples at an average of 11.34 (± 16.58) mg/kg and ranged from 1.6 to 47 mg/kg. The highest detection was located at SSALD-001 in Allendale County. Of the nonrandom background soil sampled all 12 had detections averaging 29.91 (± 25.72) mg/kg and ranged from 2.9 to 92 mg/kg. The highest detection was found in soil from McCormick County (SSMCK-001). All five riverbank soil samples detected zinc. At an average of 18.12 (± 8.70) mg/kg, the samples ranged from 2.6 to 23 mg/kg. Burton's Ferry Landing (SS301GA-001) yielded the highest riverbank soil detection. All 12 random perimeter samples, as well as all twelve background samples, had zinc detects. The random perimeter samples averaged 6.38 (± 4.43) mg/kg and ranged from 1.1 to 14 mg/kg. The highest detection was from a sample collected in quadrant E41 in Aiken County. The random background samples had detections averaging 16.23 (± 17.38) mg/kg and ranged from 2.1 to 53 mg/kg. The highest detection was from a sample collected in quadrant B46 in Oconee County, South Carolina. A number of samples exceeded the ESV of 50 although the average of all samples was below this. Conservative USEPA PRG, corresponding to a chronic risk for soil ingestion, are 23,000 mg/kg for a residential scenario and 310,000 mg/kg for an industrial land use scenario.

SRS facilities such as F and H area, tritium facilities, waste tanks and the coal-fired power plants have emitted mercury to the atmosphere (Till et al. 2001). Atmospheric fallout contributes to mercury findings in surface soil. Mercury was detected in two SRS nonrandom perimeter samples at an average of 0.11 (± 0.01) mg/kg and ranged from 0.1 to 0.11 mg/kg. The highest detection was located at in SSALD-003 in Allendale County. There was one random perimeter detection of 0.14 mg/kg from a sample collected in quadrant E49 in Allendale County. None of the random or nonrandom background samples or riverbank soil samples yielded detections above the MDL of 0.1 mg/kg for mercury. The ESV for mercury in soil is 0.1 mg/kg.
For comparison, conservative USEPA PRG, corresponding to a chronic risk for soil ingestion, are 23 mg/kg for a residential scenario and 310 mg/kg for an industrial land use scenario.

Cadmium enters the atmosphere through fuel and coal combustion (Till et al. 2001). Cadmium was detected in two SRS nonrandom perimeter samples at an average of 2.50 (± 0.85) mg/kg and ranged from 1.9 to 3.1 mg/kg. The highest detection was located at SSALD-001 in Allendale County. Of the nonrandom background soil sampled eight had detections averaging 3.98 (± 4.93) mg/kg and ranged from 1.2 to 16 mg/kg. The highest detection was found in soil from Berkeley County (SSBER-001). Four riverbank soil samples had cadmium detects. At an average of 1.35 (± 0.26) mg/kg, the samples ranged from 1.1 to 1.7 mg/kg. Steel Creek Landing (SSSCL-001) yielded the highest riverbank soil detection. One random perimeter sample, collected from quadrant E50 in Saluda County, had a cadmium detect at 1.10 mg/kg. The random background samples had detections averaging 6.10 (± 8.61) mg/kg and ranged from 1.3 to 19 mg/kg. The highest detection was from a sample collected in quadrant B46 in Oconee County. For comparison, conservative USEPA PRG, corresponding to a chronic risk for soil ingestion, are 37 mg/kg for a residential scenario and 450 mg/kg for an industrial land use scenario. While all samples exceeded the ESV of 0.38 mg/kg, the SC state average for soil is 1 mg/kg (Canova 1999).

Chromium (Cr), copper (Cu), nickel (Ni), lead (Pb), zinc (Zn), mercury (Hg) and cadmium (Cd) were all below the EPA PRG for residential soil. Additional metals were detected in surface soil: aluminum, barium, beryllium, boron, cobalt (Co), iron, magnesium, manganese, molybdenum, titanium and vanadium were found in surface soil samples. These metals were all below the USEPA PRG.

When comparing the averages of metals in surface soil, it should be noted that many of the metals occur throughout the state, not just surrounding SRS. In fact, higher concentrations of Cd, Cu and Ni were found in the background samples. Pb was on average highest in the samples collected within <50 miles of SRS and the riverbank soil samples were highest for Cr and Zn. Co was highest in the SRS nonrandom perimeter samples. Hg was only detected in the SRS nonrandom perimeter and random perimeter samples. A graph depicting the metal averages for all sample types can be found in Section 3.1.3, Figure 4. A statistical summary can be found in Section 3.1.3, Table 6. Data for all metals detected can be found in Section 3.1.4. The statistical data tables are found in Section 3.1.5. A complete list of all nonradiological analytes can be found in Section 3.1.3, Table 3.

ESOP and DOE-SR Data Comparison

Cesium-137, cobalt-60 (C0-60) and Am-241 were the only gamma emitting radionuclides where ESOP and DOE-SR shared analysis results. Since there were no detections of Co-60 in either dataset, only Cs-137 and Am-241 will be compared. DOE-SR did not analyze for alpha or beta emitting particles, nor did they analyze for metals. Samples varied by both location and in number. ESOP collected 29 samples within 50 miles of SRS while DOE-SR collected 15 samples near the SRS perimeter and within 25 miles. ESOP sampled 24 background locations greater than 50 miles from SRS in order to achieve a background average. DOE-SR sampled one background location 100 miles from SRS. Samples were collected from a variety of soil types that should be taken into consideration in regards to data interpretation.

Cesium-137 was detected within 50 miles of SRS by both DOE-SR and ESOP at a rate of 10 detections from the 15 DOE-SR samples and 23 detections of the 29 ESOP samples. It was also

detected in the DOE-SR background location and in 14 of the ESOP's 24 background locations. For the 2007 samples, the ESOP perimeter (all samples <50 miles) average for Cs-137 was 1.013 pCi/g with a standard deviation of 3.439pCi/g. The average for all the background samples was 0.293 (± 0.192) pCi/g. The DOE-SR Cs-137 average for all perimeter samples and those within 50 miles of SRS was 0.103 (± 0.045) pCi/g compared to the background concentration of 0.058 pCi/g (WSRC 2008a). The ESOP average for Cs-137 falls within one standard deviation (SD) of the DOE-SR data.

Cesium-137 was the only consistently analyzed parameter over the past several years. Trending data for Cs-137 in SRS perimeter samples is in Figure 1, Section 3.1.3. Cs-137 has been trended by ESOP since 2003. Data shows that average levels of Cs-137 in surface soils held steady from 2003 to 2005. There were slightly higher levels in 2006 and even higher levels in 2007. DOE-SR data shows steady levels from 2003-2004, slightly higher in 2005 and 2006 and the lowest average in 2007. This contrasts the ESOP data. One ESOP surface soil sample from Little Hell Landing (SSALD001) had a Cs-137 detection of 16.68 pCi/g. This landing area was resampled four months later and Cs-137 was detected at 0.0675 pCi/g. Both samples were used to calculate the 2007 average. Areas with elevated Cs-137 as found by ESOP increases the average concentration of Cs-137. This explains, in part, the difference in the trending data. Since ESOP collects more samples than DOE-SR, which includes a variety of soil types, the average level of Cs-137 in surface soil can vary due to the highly variable nature of soils. Radiocesium bioavailability in soil is influenced by soil properties such as clay content, pH, organic matter, and soil microflora (Absalom et al. 2001).

Americium-241 was detected by both DOE-SR and ESOP at a rate of nine detections from the 15 DOE-SR samples and two detections of the 29 ESOP samples. It was also detected in the DOE-SR 100 mile background location and two of the 24 ESOP background locations. The ESOP average (within 50 miles of SRS) for Am-241 was 0.515 (± 0.350) pCi/g compared to the background average of 0.435 (± 0.157) pCi/g. The DOE-SR average was 0.00578 (± 0.00314) pCi/g and the background location was 0.00435 pCi/g Am-241. The ESOP average for Am-241 falls within one standard deviation (SD) of the DOE-SR data. Comparative data can be found in Section 3.1.3, Table 7.

Statistical Summary

Background (B) sample averages were subtracted from perimeter (E) sample averages to determine the SRS random environmental concentrations above background (Tables 4-5, Section 3.1.3). If this number was greater than zero and it was a man-made radionuclide associated with SRS, then further statistical analysis was conducted. Statistical analysis of data between ESOP and DOE-SR cannot be done since DOE-SR does not conduct random sampling. However, since ESOP collects random samples, a statistical comparison can be done between SRS perimeter and SC background samples. This comparison can be used to determine the statistical significance of any differences encountered between perimeter and background samples collected by ESOP. ESOP data can be compared to DOE-SR data using standard deviation. Although the "E-B" was not greater than zero for Cs-137 for the 2007 samples, statistical testing for all samples from 2004-2007 was performed.

Statistical analyses of Cs-137 were done using ESOP random sampling averages. Nonparametric Wilcoxon Rank Sum and modified Quantile statistical tests (Michigan 2002; USEPA 2000a) are used to test the hypothesis that the study area (50-mile SRS perimeter) and the South Carolina background are the same for the stated radionuclide based locations. The 2007 surface soil Cs-137 null hypothesis was not rejected by the Wilcoxon Rank Sum. Also, the sample number to date is insufficient to support a null hypothesis rejection in favor of the alternate hypothesis that the populations are different.

When the random perimeter and random background samples were averaged, only four radionuclides had an "E-B" average greater than zero (Lead-212, Lead-214, Radium-226, and Thorium-234). These averages were calculated to provide a more accurate characterization of the contaminant concentrations throughout the sampling area. DOE-SR did not conduct analysis of these radionuclides. These are NORM and any detected levels may result from the decay of natural products. Cesium-137 is a fission product and any elevated levels could be related to anthropogenic activity. The ESOP data was used to calculate "E-B" averages from the "detects only" data for metals. Only one metal, lead, had an "E-B" average greater than zero. All of these averages were below the Region 9 Preliminary Remediation Goals (PRG) for residential soil established by the USEPA (USEPA 2002). The "E-B" average for gross alpha was 10.47, but the "E-B" average for gross beta was less than zero.

CONCLUSIONS AND RECOMMENDATIONS

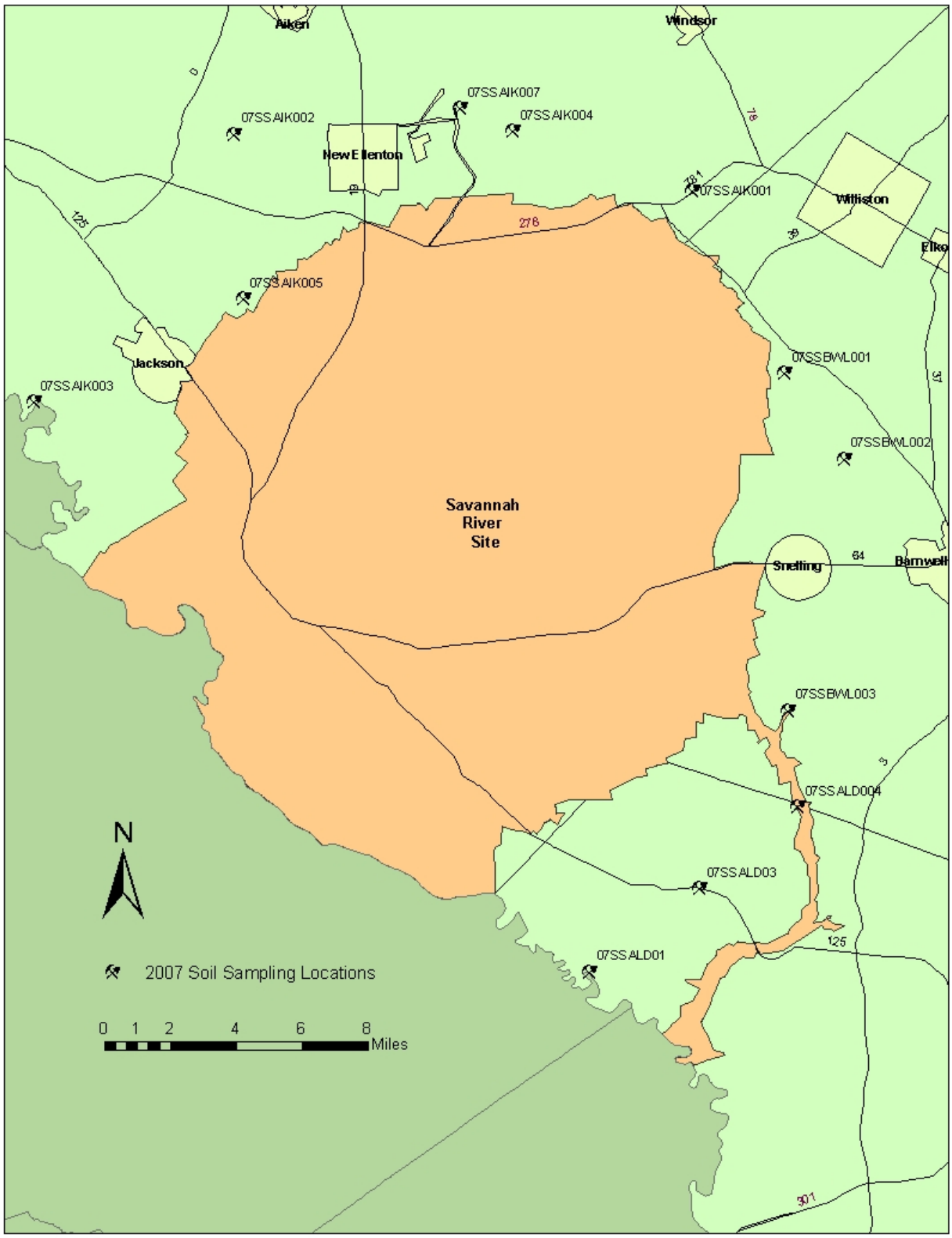
ESOP will continue independent monitoring of SRS perimeter surface soil and will periodically evaluate modification of the monitoring activities to better accomplish project goals and objectives. Monitoring will continue as long as there are activities at the SRS that create the potential for contamination entering the environment. Continued monitoring will provide an improved understanding of radionuclide and non-radionuclide activity in SRS perimeter surface soils and the surrounding areas. Additional monitoring will impart valuable information to human health exposure pathways. Trending of data over multiple years will give a clearer picture of any contaminants' presence and fate. The comparison of data results allows for independent data verification of DOE-SR monitoring activities. Cooperation between DOE-SR and ESOP provides credibility and confidence in the information being provided to the public.

In 2008, additional samples will be collected from the publicly accessible Savannah River watershed boat landings. Riverbank soils, in areas where human exposure is likely, will be analyzed for gross alpha, non-volatile beta and gamma emitting radionuclides. Additional isotopic analysis may be conducted. Also, ESOP will continue collecting random surface soil samples from South Carolina. These samples will be analyzed for radiological and non-radiological contaminants and compared to the normally sampled locations from the SRS. This will give a better view of the impacts of the SRS on the surface soil of South Carolina.

Back to Table of Contents

3.1.2
Map 8. Surface Soil Monitoring Locations

Back to Maps



3.1.3 Tables and Figures

Surface Soil Monitoring

Table 1. Random Soil Samples Collected in 2007

SRS Environmental Random Perimeter ("E") Inside of the 50-mile SRS Perimeter

Quad Designation	7.5' Quad Name	Latitude by Lat and Longitude by Long
E39X	Bull Pond(GAX)	3252.5 by 3300 and -8122.5 by -8130
E40	Blackville	3315 by 3322.5 and -8115 by -8122.5
E41	Windsor	3322.5 by 3330 and -8130 by -8137.5
E42X&B32X	Saluda South (50mi.)	3352.5 by 3400 and -8145 by -8152.5
E43	Olar	3307.5 by 3315 and -8107.5 by -8115
E44	Girard NE	3307.5 by 3315 and -8130 by -8137.5
E45	Gifford	3245 by 3252.5 and -8107.5 by -8115
E46	Cordova	3322.5 by 3330 and -8052.5 by -8100
E47X&B71	Barr Lake	3352.5 by 3400 and -8115 by -8122.5
E48X&B72X	Orangeburg N.(50mi.)	3330 by 3337.5 and -8045 by -8052.5
E49X	Millett (GAX)(NRX)	3300 by 3307.5 and -8030 by -8037.5
E50X&B75X	Batesburg(50mi.)	3352.5 by 3400 and -8130 by -8137.5

South Carolina Random Background ("B") Outside of the 50-mile SRS Perimeter

Quad Designation	7.5' Quad Name	Latitude by Lat and Longitude by Long
B37	Calhoun Creek	3400 by 3407.5 and -8222.5 by -8230
B38	Laurens North	3430 by 3437.5 and -8200 by -8207.5
B39	Saluda North	3400 by 3407.5 and -8145 by -8152.5
B40	Waterloo	3415 by 3422.5 and -8200 by -8207.5
B41X&E34X	Gilbert (50mi.)	3352.5 by 3400 and -8122.5 by -8130
B42	Reevesville	3307.5 by 3315 and -8037.5 by -8045
B43	Saint Paul	3330 by 3337.5 and -8022.5 by -8030
B44	Sandridge	3315 by 3322.5 and -8015 by -8022.5
B45	La France	3430 by 3437.5 and -8245 by -8252.5
B46X	Walhalla(50mi.)	3445 by 3452.5 and -8300 by -8307.5
B47	Clinton	3422.5 by 3430 and -8152.5 by -8200
B48	Pringletown	3307.5 by 3315 and -8015 by -8022.5

Tables and Figures
Surface Soil Monitoring

Analytes for Surface Soil Samples

Table 2. Nonradiological Analytes

Analyte	Abbreviation	MDL	Units
Silver	Ag	3.0	mg/kg
Aluminum	Al	10	mg/kg
Arsenic	As	10	mg/kg
Boron	B	10	mg/kg
Barium	Ba	5.0	mg/kg
Beryllium	Be	0.30	mg/kg
Cadmium	Cd	1.0	mg/kg
Cobalt	Co	2.0	mg/kg
Chromium	Cr	1.0	mg/kg
Copper	Cu	1.0	mg/kg
Iron	Fe	2.0	mg/kg
Mercury	Hg	0.10	mg/kg
Magnesium	Mg	5.0	mg/kg
Manganese	Mn	1.0	mg/kg
Molybdenum	Mo	2.0	mg/kg
Nickel	Ni	2.0	mg/kg
Lead	Pb	5.0	mg/kg
Antimony	Sb	5.0	mg/kg
Selenium	Se	10	mg/kg
Thallium	TI	50	mg/kg
Tin	Sn	50	mg/kg
Titanium	Ti	2.0	mg/kg
Vanadium	V	2.0	mg/kg
Zinc	Zn	1.0	mg/kg

Table 3. Radiological Analytes

Radioisotope	Abbreviation
Actinium-228	Ac-228
Americium-241	Am-241
Berylium-7	Be-7
Cerium-144	Ce-144
Cobalt-58	Co-58
Cobalt-60	Co-60
Cesium-134	Cs-134
Cesium-137	Cs-137
Europium-152	Eu-152
Europium-154	Eu-154
Europium-155	Eu-155
Iodine-131	I-131
Potassium-40	K-40
Manganese-54	Mn-54
Sodium-22	Na-22
Lead-212	Pb-212
Lead-214	Pb-214
Radium-226	Ra-226
Ruthenium-103	Ru-103
Antimony-125	Sb-125
Thorium-234	Th-234
Ytrium-88	Y-88
Zinc-65	Zn-65
Zirconium-95	Zr-95

Tables and Figures
Surface Soil Monitoring

Radiological Statistics for Surface Soils

Table 4. Gamma statistics for random SRS perimeter and SC background surface soil samples collected in 2007. Units are in picocuries per gram (pCi/g).

		Perimeter Samples (<50 miles)			Background Samples (>50 miles)			E-B	E-B
		Average	St. Deviation	Median	Average	St. Deviation	Median	Average	Median
K-40	D Only	2.802	3.313	1.529	10.497	7.881	14.210	-7.695	-12.681
	D+ 0.5 MDA ND	2.133	3.074	1.215	8.779	8.508	7.597	-6.646	-6.382
Zr-95	D Only	N/A	N/A	N/A	0.894	N/A	0.894	N/A	N/A
	D+ 0.5 MDA ND	N/A	N/A	N/A	0.127	0.243	0.060	N/A	N/A
Cs-137	D Only	0.212	0.142	0.147	0.415	0.147	0.416	-0.203	-0.269
	D+ 0.5 MDA ND	0.162	0.150	0.102	0.181	0.224	0.018	-0.019	0.084
Pb-212	D Only	0.972	0.737	0.995	0.953	0.950	0.541	0.019	0.455
	D+ 0.5 MDA ND	0.892	0.755	0.721	0.720	0.913	0.223	0.172	0.498
Pb-214	D Only	1.387	0.850	1.043	0.809	0.459	0.731	0.578	0.312
	D+ 0.5 MDA ND	1.387	0.850	1.043	0.809	0.459	0.731	0.578	0.312
Ra-226	D Only	3.380	1.685	3.142	2.283	1.150	1.905	1.097	1.237
	D+ 0.5 MDA ND	2.868	1.937	2.412	1.778	1.340	1.796	1.090	0.616
Ac-228	D Only	1.084	0.450	1.133	1.126	0.738	0.702	-0.043	0.431
	D+ 0.5 MDA ND	1.084	0.450	1.133	0.950	0.785	0.685	0.134	0.448
Th-234	D Only	5.701	N/A	5.701	3.198	0.950	3.198	2.503	2.503
	D+ 0.5 MDA ND	0.887	1.554	0.286	0.890	1.156	0.353	-0.004	-0.067
Am-241	D Only	0.762	N/A	0.762	N/A	N/A	N/A	N/A	N/A
	D+ 0.5 MDA ND	0.159	0.224	0.053	N/A	N/A	N/A	N/A	N/A

Notes:
D= Detects
MDA= Minimum Detectable Amount
ND= Non Detect

Table 5. Alpha and beta statistics for random SRS perimeter and SC background surface soil samples collected in 2007. Units are in picocuries per gram (pCi/g).

	Perimeter Samples (<50 Miles)			Background Samples (>50 Samples)			E-B	E-B
	Average	St. Deviation	Median	Average	St. Deviation	Median	Average	Median
Alpha	28.67	9.51	26.10	18.20	N/A	18.20	10.47	7.90
Beta	16.10	N/A	16.10	16.35	3.07	15.35	-0.25	0.75

Tables and Figures
Surface Soil Monitoring

Nonradiological Statistics for Surface Soils

Table 6. Metals statistics for all SRS perimeter and SC background samples collected in 2007. Units are in milligrams per kilogram (mg/kg).

	Perimeter Samples (<50 Miles)			Background Samples (>50 Miles)			E-B	E-B
	Average	Standard Deviation	Median	Average	Standard Deviation	Median	Average	Median
Aluminum	6771.03	12555.65	3500.00	21341.67	39992.86	6900.00	-14570.63	-3400.00
Barium	42.66	44.88	22.00	67.20	48.11	52.00	-24.55	-30.00
Beryllium	0.52	0.24	0.38	0.52	0.21	0.43	0.00	-0.05
Boron	130.71	79.12	150.00	250.00	N/A	250.00	-119.29	-100.00
Cadmium	1.64	0.71	1.40	4.68	6.06	2.05	-3.04	-0.65
Cobalt	7.05	3.30	6.15	9.35	4.44	8.70	-2.30	-2.55
Chromium	8.27	6.58	5.30	13.66	9.66	14.00	-5.39	-8.70
Copper	4.26	5.63	1.80	9.74	7.07	9.00	-5.48	-7.20
Iron	7146.21	12292.55	3200.00	24725.00	56137.00	11000.00	-17578.79	-7800.00
Mercury	0.12	0.02	0.11	N/A	N/A	N/A	N/A	N/A
Magnesium	357.07	493.82	100.00	934.38	1112.62	510.00	-577.31	-410.00
Manganese	205.35	346.60	34.00	389.52	411.80	290.00	-184.17	-256.00
Molybdenum	N/A	N/A	N/A	2.60	N/A	2.60	N/A	N/A
Nickel	4.20	2.00	3.55	8.65	3.37	8.90	-4.45	-5.35
Lead	16.90	11.51	13.00	14.51	8.97	12.00	2.39	1.00
Titanium	126.79	146.44	52.00	334.79	465.66	140.00	-208.00	-88.00
Vanadium	12.81	12.76	7.30	27.20	25.03	19.00	-14.39	-11.70
Zinc	10.46	12.02	5.00	23.07	22.58	14.00	-12.61	-9.00

Tables and Figures
Surface Soil Monitoring

Radiological Surface Soil Data

Table 7. Surface Soil Data Comparison: SCDHEC and DOE-SR Surface Soil Data

SCDHEC-ESOP Samples <50 Miles From SRS

Sample ID	County	Cs-137	Am-241
SSE39	ALLENDALE	ND	ND
SSE40	BARNWELL	**0.0654**	ND
SSE41	AIKEN	**0.3302**	ND
SSE42	SALUDA	ND	ND
SSE43	BAMBERG	ND	ND
SSE44	ALLENDALE	**0.1031**	ND
SSE45	HAMPTON	**0.0623**	ND
SSE46	ORANGEBURG	**0.1474**	**0.7622**
SSE47	LEXINGTON	**0.1011**	ND
SSE48	ORANGEBURG	**0.3557**	ND
SSE49	ALLENDALE	**0.4199**	ND
SSE50	SALUDA	**0.3199**	ND
SSAIK001	AIKEN	**0.1511**	**0.2669**
SSAIK002	AIKEN	ND	ND
SSAIK003	AIKEN	**0.1703**	ND
SSAIK004	AIKEN	ND	ND
SSAIK005	AIKEN	**0.1017**	ND
SSAIK 007	AIKEN	**0.0875**	ND
SSBWL001	BARNWELL	**0.1985**	ND
SSBWL002	BARNWELL	ND	ND
SSBWL003	BARNWELL	**0.202**	ND
SSALD001	ALLENDALE	**16.68**	ND
SSALD-003	ALLENDALE	**0.4206**	ND
SSALD-004	ALLENDALE	**0.2235**	ND
301 Bridge	ALLENDALE	**0.3151**	ND
Burton's Ferry	SCREVEN	**0.3505**	ND
Little Hell	ALLENDALE	**0.0675**	ND
Steel Creek Landing	BARNWELL	**2.088**	ND
Jackson Boat Landing	AIKEN	**0.3418**	ND
AVG		**1.0132**	**0.5146**
MEDIAN		**0.2020**	**0.5146**
STD		**3.4395**	**0.3502**

SCDHEC-ESOP Background Samples >50 Miles From SRS

Sample ID	County	Cs-137	Am-241
SSB37	ABBEVILLE	ND	ND
SSB38	LAURENS	ND	ND
SSB39	SALUDA	ND	ND
SSB40	LAURENS	ND	ND
SSB41	LEXINGTON	ND	ND
SSB42	DORCHESTER	ND	ND
SSB43	ORANGEBURG	ND	ND
SSB44	ORANGEBURG	**0.2055**	ND
SSB45	ANDERSON	**0.3548**	ND
SSB46	OCONEE	**0.5159**	ND
SSB47	LAURENS	**0.5831**	ND
SSB48	DORCHESTER	**0.4162**	ND
SSMCK001	McCORMICK	**0.3381**	**0.3239**
SSMCK002	McCORMICK	**0.1476**	ND
SSEFD001	EDGEFIELD	**0.0892**	ND
SSSAL001	SALUDA	ND	ND
SSAND001	ANDERSON	**0.1009**	**0.5455**
SSDAR001	DARLINGTON	**0.1682**	ND
SSGRN001	GREENWOOD	**0.2505**	ND
SSNEW001	NEWBERRY	ND	ND
SSCOL-001	COLLETON	**0.1859**	ND
SSCLA-001	CLARENDON	**0.0947**	ND
SSCAL-001	CALHOUN	**0.2266**	ND
SSBER-001	BERKELEY	**0.7188**	ND
AVG		**0.2931**	**0.4347**
MEDIAN		**0.2266**	**0.4347**
STD		**0.1920**	**0.1567**

DOE-SR Off-Site Samples <50 Miles from SRS

Sample Location	Cs-137	Am-241
Allendale Gate	ND	ND
Barnwell Gate	ND	ND
D-Area	**0.0886**	**0.0019**
Darkhorse @ Williston Gate	**0.1280**	**0.0072**
East Talatha	**0.0651**	ND
Green Pond	ND	**0.0051**
Highway 21/167	**0.0762**	**0.0050**
Jackson	ND	**0.0084**
Patterson Mill Road	**0.0741**	**0.0026**
Talatha Gate	**0.0689**	ND
West Jackson	ND	**0.0059**
Windsor Road	**0.0905**	ND
Aiken Airport	**0.2180**	**0.0121**
Augusta Lock and Dam 614	**0.1120**	ND
Highway 301 @ State Line	**0.1110**	**0.0039**
AVG	**0.1032**	**0.0058**
MEDIAN	**0.0896**	**0.0051**
STD	**0.0454**	**0.0031**

DOE-SR Background Sample

Sample Location	Cs-137	Am-241
100-Mile Radius Savannah, GA	**0.0584**	**0.00435**

Tables and Figures
Surface Soil Monitoring

Radiological Analyses for Surface Soils

Figure 1. Cs-137 Trending to Compare DOE-SR and SCDHEC Data

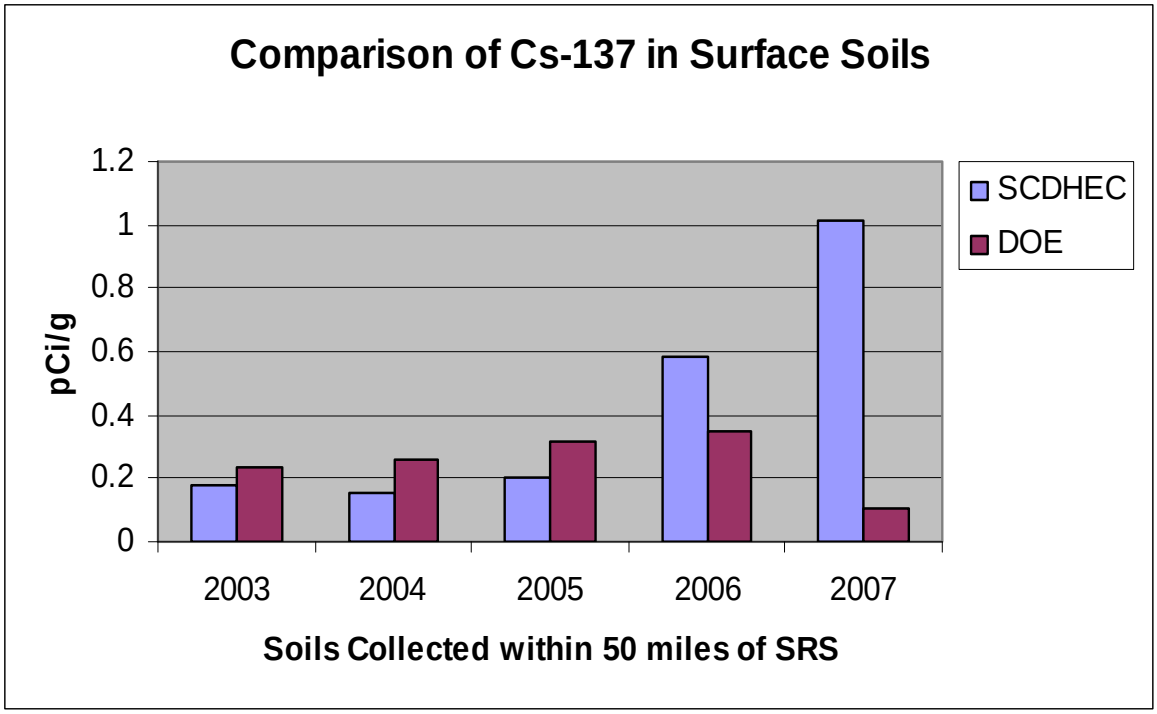
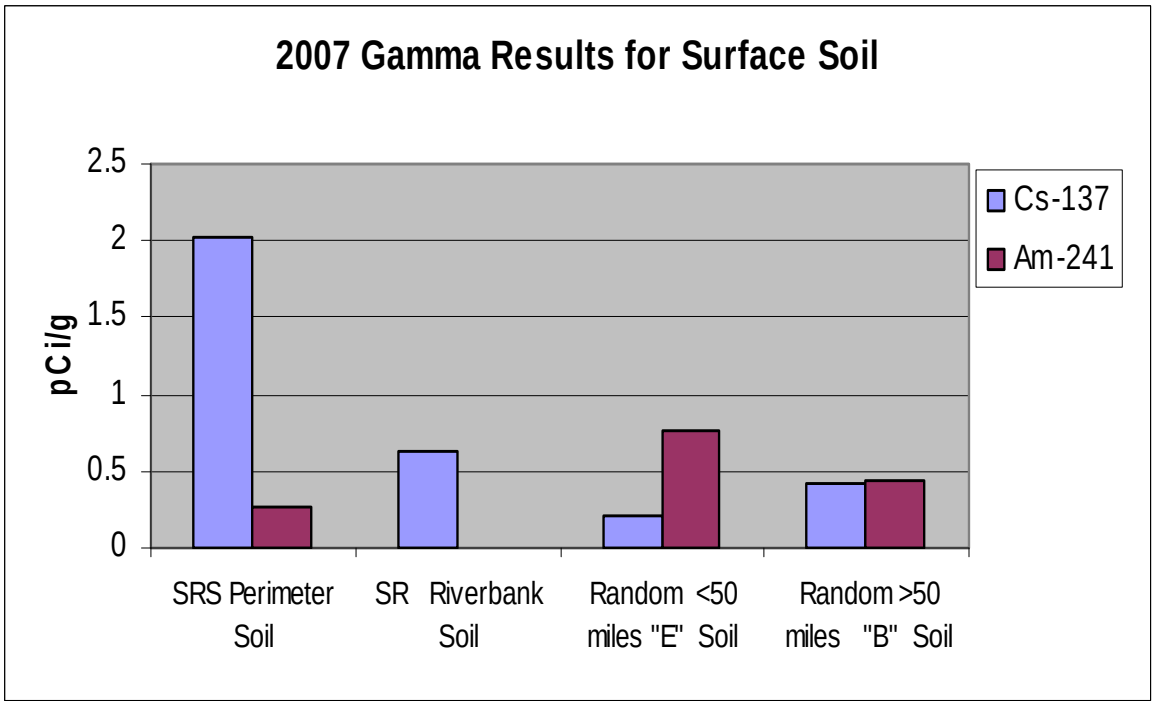


Figure 2. Cs-137 and Am-241 Results by Sample Group



Tables and Figures
Surface Soil Monitoring

Back to Tables and Figures

Radiological and Nonradiological Analyses for Surface Soils

Figure 3. Alpha and Beta Results by Sample Group

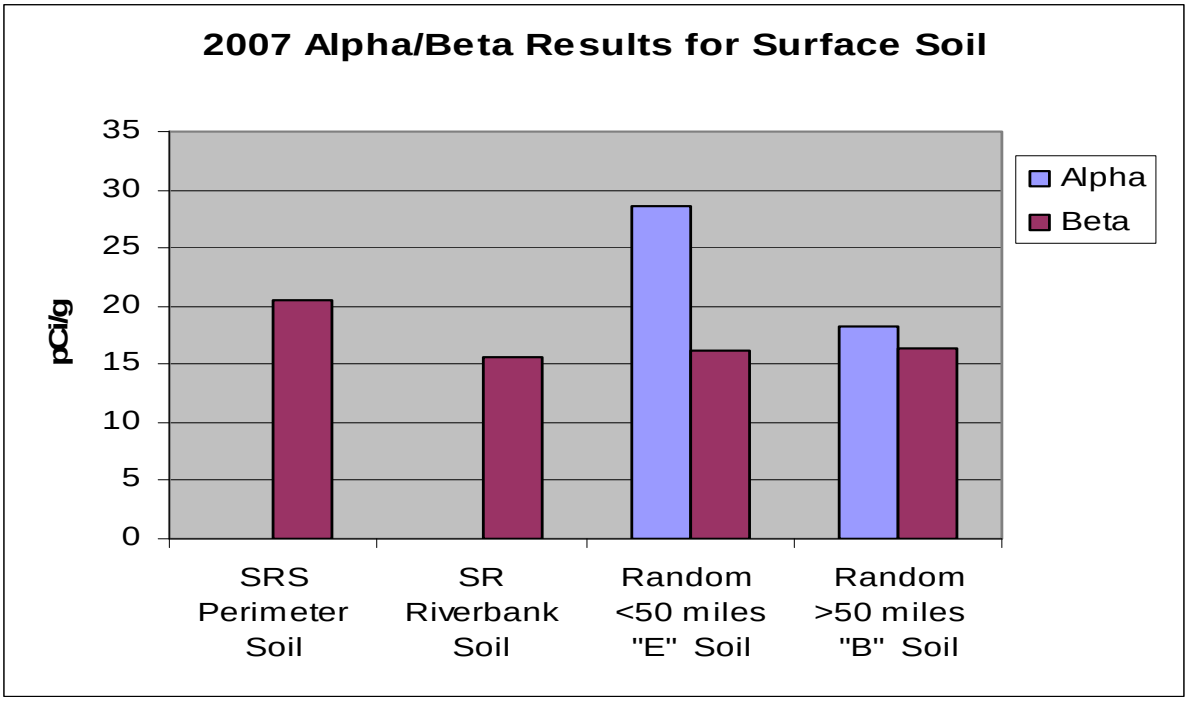
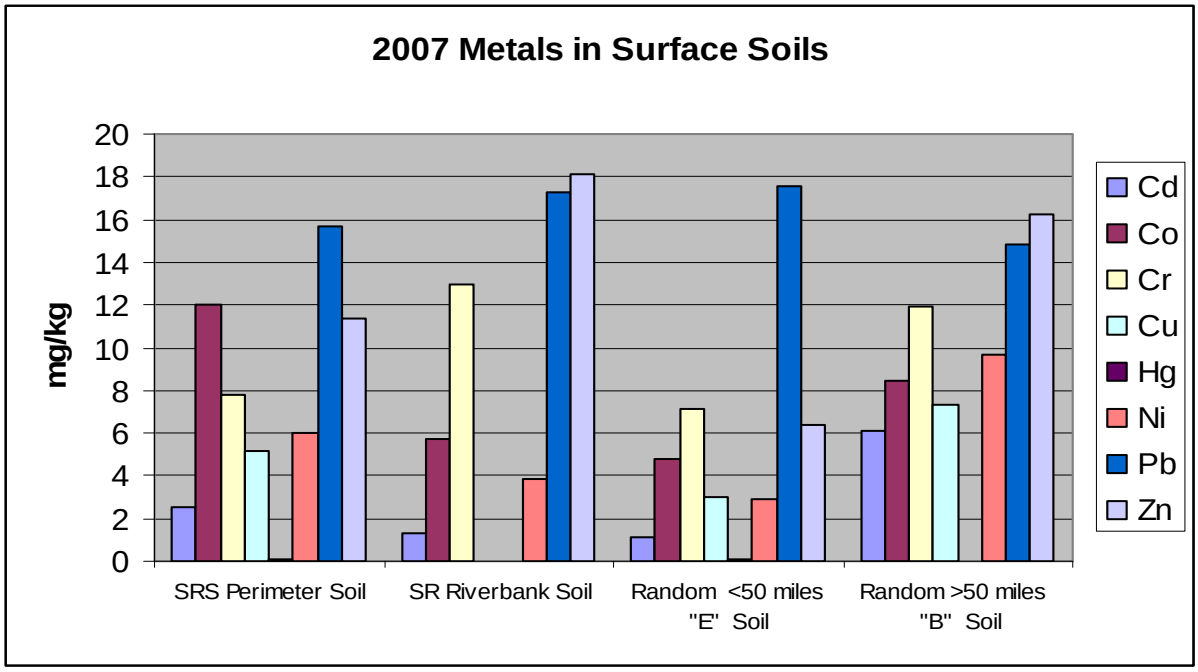


Figure 4. Metal Analyses Results by Sample Group



3.1.4 Data

Surface Soil Monitoring

2007 Radiological Data 222

2007 Nonradiological Data 234

Notes:
1. Bold numbers denotes a detection.
2. A blank field following ±2 SIGMA occurs when the sample is <LLD.
3. LLD= Lower Limit of Detection
4. MDA= Minimum Detectable Activity

Back to List of Data Tables

Surface Soil Monitoring Data

2007 Surface Soil Alpha Beta SRS Non-Random Perimeter Samples <50 miles

Sample Location:	SSAIK001	SSAIK002	SSAIK003	SSAIK004	SSAIK005	SSAIK007
County	Aiken	Aiken	Aiken	Aiken	Aiken	Aiken
Date Collected:	6/5/2007	6/5/2007	7/13/2007	8/14/2007	8/16/2007	12/28/2007
UNITS	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
Gross Alpha	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
±2 SIGMA						
LLD	24.5	24.5	20.4	22.8	21.6	25.2
N-V Beta	<LLD	<LLD	<LLD	<LLD	<LLD	**25.0**
±2 SIGMA						**8.2**
LLD	12.3	13.7	13.3	16.2	18.0	**12.3**

Sample Location:	SSBWL001	SSBWL002	SSBWL003	SSALD001	SSALD003	SSALD004
County	Barnwell	Barnwell	Barnwell	Allendale	Allendale	Allendale
Date Collected:	6/5/2007	6/20/2007	6/20/2007	8/20/2007	11/28/2007	11/28/2007
UNITS	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
Gross Alpha	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
±2 SIGMA						
LLD	29.2	24.7	26.4	22.9	26.0	26.2
N-V Beta	**9.71**	<LLD	**26.8**	<LLD	<LLD	<LLD
±2 SIGMA	**5.02**		**5.93**			
LLD	**8.27**	8.18	**8.00**	8.73	8.89	8.67

2007 Surface Soil Alpha Beta SRS Non-Random Background Samples >50 miles

Sample Location:	SSMCK001	SSMCK002	SSEFD001	SSSAL001	SSAND001	SSDAR001
County	McCormick	McCormick	Edgefield	Saluda	Anderson	Darlington
Date Collected:	6/25/2007	6/25/2007	6/25/2007	6/25/2007	8/6/2007	8/21/2007
UNITS	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
Gross Alpha	<LLD	<LLD	<LLD	<LLD	**24.1**	<LLD
±2 SIGMA					**17.2**	
LLD	25.4	23.6	26.9	24.0	**19.8**	22.6
N-V Beta	<LLD	<LLD	<LLD	<LLD	**29.7**	<LLD
±2 SIGMA					**10.3**	
LLD	15.2	33.9	16.3	11.6	**15.8**	8.20

Sample Location:	SSGRN001	SSNEW001	SSCOL001	SSCLA001	SSCAL001	SSBER001
County	Greenwood	Newberry	Colleton	Clarendon	Calhoun	Berkeley
Date Collected:	8/23/2007	8/23/2007	12/4/2007	12/16/2007	12/16/2007	12/11/2007
UNITS	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
Gross Alpha	<LLD	**26.7**	<LLD	<LLD	<LLD	<LLD
±2 SIGMA		**17.5**				
LLD	22.9	**22.6**	25.7	25.4	25.3	26.1
N-V Beta	**7.80**	**15.9**	**16.3**	<LLD	<LLD	**14.6**
±2 SIGMA	**4.38**	**5.41**	**5.43**			**5.47**
LLD	**7.45**	**8.30**	**8.57**	8.59	8.75	**8.89**

Surface Soil Monitoring Data

2007 Surface Soil Alpha Beta SRS Random Perimeter "E" Samples <50 miles

Sample Location:	SSE39	SSE40	SSE41	SSE42	SSE43	SSE44
County	Allendale	Barnwell	Aiken	Saluda	Bamberg	Barnwell
Date Collected:	5/9/2007	3/29/2007	3/22/2007	3/26/2007	5/24/2007	5/9/2007
UNITS	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
Gross Alpha	<LLD	**20.7**	**39.2**	<LLD	<LLD	<LLD
±2 SIGMA		**13.5**	**17.8**			
LLD	24.3	**12.1**	**12.2**	11.9	28.0	25.0
N-V Beta	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
±2 SIGMA						
LLD	15.9	10.1	21.7	13.1	15.7	17.0

Sample Location:	SSE45	SSE46	SSE47	SSE48	SSE49	SSE50
County	Hampton	Orangeburg	Lexington	Orangeburg	Allendale	Saluda
Date Collected:	7/26/2007	7/17/2007	7/19/2007	11/29/2007	11/28/2007	12/18/2007
UNITS	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
Gross Alpha	**26.1**	<LLD	<LLD	<LLD	<LLD	<LLD
±2 SIGMA	**17.3**					
LLD	**19.1**	19.0	16.9	25.7	25.9	26.2
N-V Beta	<LLD	<LLD	<LLD	<LLD	<LLD	**16.1**
±2 SIGMA						**5.75**
LLD	29.6	13.2	13.7	9.09	8.77	**9.25**

2007 Surface Soil Alpha Beta SRS Random Background "B" Samples >50 miles

Sample Location:	SSB37	SSB38	SSB39	SSB40	SSB41	SSB42
County	Abbeville	Laurens	Saluda	Greenwood	Lexington	Dorchester
Date Collected:	3/27/2007	3/27/2007	3/26/2007	4/26/2007	7/19/2007	5/1/2007
UNITS	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
Gross Alpha	<LLD	**18.2**	<LLD	<LLD	<LLD	<LLD
±2 SIGMA		**12.9**				
LLD	12.5	**12.1**	13.0	24.4	17.3	24.0
N-V Beta	<LLD	**14.4**	<LLD	<LLD	<LLD	<LLD
±2 SIGMA		**6.46**				
LLD	10.8	**10.9**	8.95	13.3	15.2	9.14

Sample Location:	SSB43	SSB44	SSB45	SSB46	SSB47	SSB48
County	Orangeburg	Orangeburg	Anderson	Oconee	Laurens	Dorchester
Date Collected:	7/31/2007	8/17/2007	8/6/2007	12/17/2007	12/21/2007	12/4/2007
UNITS	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
Gross Alpha	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
±2 SIGMA						
LLD	17.0	23.1	17.9	25.9	25.6	25.7
N-V Beta	**14.0**	<LLD	<LLD	**16.30**	**20.70**	<LLD
±2 SIGMA	**5.64**			**5.69**	**5.74**	
LLD	**8.92**	8.26	21.3	**9.11**	**8.73**	8.74

Surface Soil Monitoring Data

2007 Riverbank Soil Alpha Beta Data

Sample ID	SS 301SC 001	SS 301GA 001	SS LHL 001	SS SCL 001	SS JBL 001
Location Name	301 Bridge	Burton's Landing	Little Hell	Steel Creek Landing	Jackson Boat Landing
County	Allendale	Screven	Allendale	Barnwell	Aiken
Collection Date	27 Dec 2007	27 Dec 2007	27 Dec 2007	27 Dec 2007	27 Dec 2007
UNITS	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
Gross Alpha	<LLD	<LLD	<LLD	<LLD	<LLD
±2 SIGMA					
LLD	25.1	25.0	24.9	25.7	26.0
N-V Beta	**12.2**	**15.6**	<LLD	**18.2**	**16.5**
±2 SIGMA	**5.47**	**5.73**		**5.65**	**5.67**
LLD	**9.18**	**9.30**	8.96	**8.80**	**9.08**

Surface Soil Monitoring Data

2007 ESOP Riverbank Soil Gamma Data

Sample ID	SS 301SC 001	SS 301GA 001	SS LHL 001	SS SCL 001	SS JBL 001
Location Name	301 Bridge	Burton's Ferry	Little Hell	Steel Creek Landing	Jackson Boat Landing
County	Allendale	Screven	Allendale	Barnwell	Aiken
Collection Date	12/27/2007	12/27/2007	12/27/2007	12/27/2007	12/27/2007
Analysis Date	3/3/2008	3/4/2008	3/4/2008	3/4/2008	2/29/2008
Analyte and Results					
K-40	**15.13**	**15.72**	**3.909**	**16.32**	**12.01**
Confidence Interval (± 2 SD)	**1.293**	**1.273**	**0.4042**	**1.305**	**1.054**
MDA	**0.3496**	**0.3293**	**0.1695**	**0.3384**	**0.3633**
Cs-137	**0.3151**	**0.3505**	**0.0675**	**2.088**	**0.3418**
Confidence Interval (± 2 SD)	**0.0453**	**0.0453**	**0.0291**	**0.1535**	**0.0429**
MDA	**0.0550**	**0.0501**	**0.0238**	**0.0490**	**0.0458**
Pb-212	**1.493**	**1.170**	<MDA	<MDA	<MDA
Confidence Interval (± 2 SD)	**0.1509**	**0.1205**			
MDA	**0.0617**	**0.0573**	0.0296	0.0627	0.0357
Pb-214	**1.345**	**1.455**	**0.3354**	**1.287**	**1.270**
Confidence Interval (± 2 SD)	**0.1010**	**0.1047**	**0.0368**	**0.1041**	**0.0891**
MDA	**0.0992**	**0.0941**	**0.0479**	**0.1018**	**0.0879**
Ra-226	**3.025**	**2.831**	**0.9571**	**3.272**	**3.358**
Confidence Interval (± 2 SD)	**0.8925**	**0.8610**	**0.3571**	**0.8409**	**0.7744**
MDA	**1.052**	**1.033**	**0.5416**	**1.112**	**0.9952**
Ac-228	**1.388**	**1.175**	**0.5187**	**1.403**	**1.321**
Confidence Interval (± 2 SD)	**0.1407**	**0.1490**	**0.0655**	**0.1454**	**0.1458**
MDA	**0.1815**	**0.1814**	**0.0833**	**0.1706**	**0.1589**
Th-234	<MDA	<MDA	<MDA	<MDA	**1.2990**
Confidence Interval (± 2 SD)					**0.6375**
MDA	1.160	1.005	0.5151	0.9756	**0.5108**

Note: There were no detections for Am-241, Be-7, Ce-144, Co-58, Co-60, Cs-134, Eu-152, Eu-154, Eu-155, I-131, Mn-54, Na-22, Ru-103, Sb-125, Y-88, Zn-65, and Zr-95.

Surface Soil Monitoring Data

2007 ESOP Gamma Soil Data
Non-Random Perimeter Samples

Sample ID	SSAIK001	SSAIK002	SSAIK003	SSAIK004	SSAIK005	SSAIK007
County	AIKEN	AIKEN	AIKEN	AIKEN	AIKEN	AIKEN
Collection Date	6/05/2007	6/05/2007	7/13/2007	8/14/2007	8/16/2007	12/28/2007
Analysis Date	8/08/2007	8/08/2007	10/8/2007	10/11/2007	10/12/2007	2/27/2008
Analyte and Results	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
K-40	<MDA	<MDA	**14.42**	**1.271**	**0.5102**	**1.084**
Confidence Interval (± 2 SD)			**1.341**	**0.2815**	**0.1929**	**0.3565**
MDA	0.2378	0.2788	**0.4816**	**0.3102**	**0.1771**	**0.2653**
Cs-137	**0.1511**	<MDA	**0.1703**	<MDA	**0.1017**	**0.0875**
Confidence Interval (± 2 SD)	**0.0314**		**0.0564**		**0.0282**	**0.0362**
MDA	**0.0360**	0.0366	**0.0659**	0.0400	**0.0260**	**0.0361**
Pb-212	**1.299**	**1.234**	<MDA	<MDA	<MDA	<MDA
Confidence Interval (± 2 SD)	**0.5932**	**0.5381**				
MDA	**0.0464**	**0.0432**	0.0696	0.0436	0.0346	0.0451
Pb-214	**0.7763**	**0.6676**	**1.939**	**2.176**	**0.5110**	**0.9444**
Confidence Interval (± 2 SD)	**0.0671**	**0.0615**	**0.1372**	**0.1170**	**0.0520**	**0.0885**
MDA	**0.0695**	**0.0669**	**0.1276**	**0.0736**	**0.0552**	**0.0710**
Ra-226	**1.931**	**1.814**	**3.877**	**3.612**	**1.018**	**2.056**
Confidence Interval (± 2 SD)	**0.6771**	**0.6912**	**1.108**	**0.7718**	**0.4754**	**0.7507**
MDA	**0.7868**	**0.7143**	**1.338**	**0.8869**	**0.5997**	**0.7809**
Ac-228	**1.241**	**1.087**	**1.531**	**1.343**	**0.6190**	**0.9650**
Confidence Interval (± 2 SD)	**0.1322**	**0.0995**	**0.1946**	**0.1196**	**0.0702**	**0.1253**
MDA	**0.1133**	**0.1005**	**0.2358**	**0.1195**	**0.0904**	**0.1122**
Th-234	<MDA	<MDA	**6.861**	<MDA	<MDA	<MDA
Confidence Interval (± 2 SD)			**3.221**			
MDA	0.4881	0.4595	**1.231**	0.9594	0.6633	0.7394
Am-241	**0.2669**	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (± 2 SD)	**0.1298**					
MDA	**0.0973**	0.1070	0.1941	0.1048	0.0850	0.1115

Note: There were no detections for Be-7, Ce-144, Co-58, Co-60, Cs-134, Eu-152, Eu-154, Eu-155, I-131, Mn-54, Na-22, Ru-103, Sb-125, Y-88, Zn-65, and Zr-95.

Surface Soil Monitoring Data

2007 ESOP Gamma Soil Data
Non-Random Perimeter Samples

Sample ID	SSBWL001	SSBWL002	SSBWL003	SSALD001	SSALD-003	SSALD-004
County	BARNWELL	BARNWELL	BARNWELL	ALLENDALE	ALLENDALE	ALLENDALE
Collection Date	6/05/2007	6/20/2007	6/20/2007	8/20/2007	11/28/2007	11/28/2007
Analysis Date	8/07/2007	8/09/2007	8/10/2007	10/15/2007	3/24/2008	3/24/2008
Analyte and Results	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
K-40	**0.7850**	<MDA	**1.054**	**10.50**	**2.436**	<MDA
Confidence Interval (± 2 SD)	**0.3496**		**0.3246**	**1.034**	**0.5613**	
MDA	**0.3231**	0.3314	**0.2601**	**0.4370**	**0.3177**	0.2616
Cs-137	**0.1985**	<MDA	**0.2020**	**16.68**	**0.4206**	**0.2235**
Confidence Interval (± 2 SD)	**0.0378**		**0.0480**	**1.108**	**0.0598**	**0.0565**
MDA	**0.0504**	0.0400	**0.0380**	**0.0719**	**0.0374**	**0.0360**
Pb-212	**2.197**	**1.145**	**1.115**	**1.897**	**1.494**	**1.534**
Confidence Interval (± 2 SD)	**0.9069**	**0.1169**	**0.1138**	**0.1998**	**0.1446**	**0.9167**
MDA	**0.0664**	**0.0446**	**0.0492**	**0.0862**	**0.0695**	**0.0659**
Pb-214	**1.293**	**1.246**	**0.7554**	**2.352**	**1.590**	**1.687**
Confidence Interval (± 2 SD)	**0.1029**	**0.0920**	**0.0814**	**0.1831**	**0.1176**	**0.1171**
MDA	**0.1013**	**0.0814**	**0.0775**	**0.1970**	**0.0788**	**0.0776**
Ra-226	**3.285**	**2.346**	**1.787**	**5.219**	**2.869**	**2.511**
Confidence Interval (± 2 SD)	**1.141**	**0.7406**	**0.6623**	**1.458**	**1.095**	**0.7483**
MDA	**1.144**	**0.9266**	**0.8415**	**1.861**	**0.8790**	**0.8009**
Ac-228	**2.040**	**1.122**	**0.8908**	**2.190**	**1.536**	**1.483**
Confidence Interval (± 2 SD)	**0.1606**	**0.1324**	**0.1012**	**0.1983**	**0.1367**	**0.1374**
MDA	**0.1549**	**0.1368**	**0.1269**	**0.1951**	**0.1323**	**0.1239**
Th-234	<MDA	**3.470**	<MDA	<MDA	<MDA	<MDA
Confidence Interval (± 2 SD)		**1.660**				
MDA	0.6866	**0.5632**	0.6825	1.473	2.286	2.210
Am-241	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (± 2 SD)						
MDA	0.1695	0.1267	0.1179	0.2105	0.6896	0.6884

Note: There were no detections for Be-7, Ce-144, Co-58, Co-60, Cs-134, Eu-152, Eu-154, Eu-155, I-131, Mn-54, Na-22, Ru-103, Sb-125, Y-88, Zn-65, and Zr-95.

Surface Soil Monitoring Data

2007 ESOP Gamma Soil Data

Non-Random Background Samples

Sample ID	SSMCK001	SSMCK002	SSEFD001	SSSAL001	SSAND001	SSDAR001
County	McCORMICK	McCORMICK	EDGEFIELD	SALUDA	ANDERSON	DARLINGTON
Collection Date	6/25/2007	6/25/2007	6/25/2007	6/25/2007	8/6/2007	8/21/2007
Analysis Date	8/10/2007	8/10/2007	8/13/2007	8/13/2007	10/11/2007	10/15/2007
Analyte and Results	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
K-40	**10.33**	**6.257**	**6.596**	**10.40**	**16.19**	**0.5779**
Confidence Interval (± 2 SD)	**0.9125**	**0.7153**	**0.7641**	**0.8692**	**1.295**	**0.2722**
MDA	**0.2703**	**0.2822**	**0.2839**	**0.2479**	**0.3987**	**0.2871**
Zr-95	<MDA	<MDA	<MDA	<MDA	**0.4871**	<MDA
Confidence Interval (± 2 SD)					**0.1671**	
MDA	0.1041	0.1016	0.1255	0.0955	**0.1668**	0.1018
Cs-137	**0.3381**	**0.1476**	**0.0892**	<MDA	**0.1009**	**0.1682**
Confidence Interval (± 2 SD)	**0.0568**	**0.0475**	**0.0386**		**0.0452**	**0.0412**
MDA	**0.0411**	**0.0381**	**0.0428**	0.0335	**0.0484**	**0.0361**
Pb-212	**0.8047**	**0.8370**	<MDA	<MDA	<MDA	**0.9931**
Confidence Interval (± 2 SD)	**0.0894**	**0.0906**				**0.1041**
MDA	**0.0451**	**0.0469**	0.0493	0.0394	0.0517	**0.0372**
Pb-214	**0.6955**	**0.7791**	**0.6697**	**1.017**	**1.085**	**0.6441**
Confidence Interval (± 2 SD)	**0.0668**	**0.0755**	**0.0746**	**0.0749**	**0.1039**	**0.0623**
MDA	**0.0802**	**0.0715**	**0.0829**	**0.0631**	**0.0909**	**0.0692**
Ra-226	**1.495**	<MDA	<MDA	**2.084**	**2.129**	**1.582**
Confidence Interval (± 2 SD)	**0.7067**			**0.5875**	**0.8832**	**0.6273**
MDA	**0.8094**	0.8271	0.8935	**0.7036**	**0.9818**	**0.7433**
Ac-228	**0.7528**	<MDA	**0.9008**	**0.6616**	**1.335**	**0.7944**
Confidence Interval (± 2 SD)	**0.0956**		**0.1190**	**0.0946**	**0.1353**	**0.0874**
MDA	**0.1450**	0.2446	**0.1397**	**0.1203**	**0.1620**	**0.1116**
Am-241	**0.3239**	<MDA	<MDA	<MDA	**0.5455**	<MDA
Confidence Interval (± 2 SD)	**0.1270**				**0.1745**	
MDA	**0.0990**	0.1127	0.1233	0.0974	**0.1225**	0.0909

Note: There were no detections for Be-7, Ce-144, Co-58, Co-60, Cs-134, Eu-152, Eu-154, Eu-155, I-131, Mn-54, Na-22, Ru-103, Sb-125, Th-234, Y-88, and Zn-65.

Surface Soil Monitoring Data

2007 ESOP Gamma Soil Data
Non-Random Background Samples

Sample ID	SSGRN001	SSNEW001	SSCOL-001	SSCLA-001	SSCAL-001	SSBER-001
County	GREENWOOD	NEWBERRY	COLLETON	CLARENDON	CALHOUN	BERKELEY
Collection Date	8/23/2007	8/23/2007	12/4/2007	12/16/2007	12/16/2007	12/11/2007
Analysis Date	10/15/2007	10/16/2007	3/24/2008	3/25/2008	3/25/2008	3/25/2008
Analyte and Results	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
K-40	**6.489**	**14.52**	**3.364**	**2.146**	**1.615**	**7.828**
Confidence Interval (± 2 SD)	**0.6758**	**1.267**	**0.5819**	**0.5145**	**0.4357**	**0.8730**
MDA	**0.2430**	**0.3705**	**0.3489**	**0.2488**	**0.2131**	**0.3142**
Zr-95	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (± 2 SD)						
MDA	0.1114	0.1550	0.2140	0.1427	0.1442	0.2015
Cs-137	**0.2505**	<MDA	**0.1859**	**0.0947**	**0.2266**	**0.7188**
Confidence Interval (± 2 SD)	**0.0451**		**0.0394**	**0.0303**	**0.0378**	**0.0780**
MDA	**0.0348**	0.0538	**0.0380**	**0.0326**	**0.0294**	**0.0385**
Pb-212	<MDA	**1.930**	<MDA	**0.8531**	**0.4160**	**1.503**
Confidence Interval (± 2 SD)		**0.1872**		**0.0945**	**0.0617**	**0.7073**
MDA	0.0402	**0.0657**	0.0693	**0.0564**	**0.0550**	**0.0703**
Pb-214	**0.5769**	**1.203**	**2.740**	**1.066**	**0.7030**	**1.5470**
Confidence Interval (± 2 SD)	**0.0578**	**0.0970**	**0.1580**	**0.0851**	**0.0752**	**0.1129**
MDA	**0.0722**	**0.1045**	**0.0775**	**0.0699**	**0.0657**	**0.0790**
Ra-226	**1.225**	**2.730**	**4.512**	**0.1953**	<MDA	**3.023**
Confidence Interval (± 2 SD)	**0.4973**	**0.9591**	**0.8430**	**0.7875**		**0.8214**
MDA	**0.7491**	**1.118**	**0.8919**	**0.7795**	0.6987	**0.8447**
Ac-228	**0.7092**	**1.795**	**1.108**	**1.018**	**0.5077**	**1.573**
Confidence Interval (± 2 SD)	**0.1006**	**0.1520**	**0.1309**	**0.1142**	**0.0976**	**0.1427**
MDA	**0.1195**	**0.1928**	**0.1409**	**0.1088**	**0.1015**	**0.1262**
Am-241	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (± 2 SD)						
MDA	0.1028	0.1591	0.7014	0.5880	0.5409	0.6901

Note: There were no detections for Be-7, Ce-144, Co-58, Co-60, Cs-134, Eu-152, Eu-154, Eu-155, I-131, Mn-54, Na-22, Ru-103, Sb-125, Th-234, Y-88, and Zn-65.

Surface Soil Monitoring Data

2007 ESOP Gamma Soil Data SRS Random Perimeter "E" Samples <50 miles

Sample ID	SSE39	SSE40	SSE41	SSE42	SSE43	SSE44
County	ALLENDALE	BARNWELL	AIKEN	SALUDA	BAMBERG	ALLENDALE
Collection Date	5/09/2007	3/29/2007	3/22/2007	3/26/2007	5/24/2007	5/09/2007
Analyte and Results	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
K-40	**0.8471**	**0.9690**	**1.4610**	**2.2640**	<MDA	<MDA
Confidence Interval (± 2 SD)	**0.2786**	**0.2565**	**0.3553**	**0.3239**		
MDA	**0.2209**	**0.1774**	**0.2782**	**0.1523**	0.2063	0.2580
Cs-137	<MDA	**0.0654**	**0.3302**	<MDA	<MDA	**0.1031**
Confidence Interval (± 2 SD)		**0.0262**	**0.0480**			**0.0344**
MDA	0.0358	**0.0247**	**0.0292**	0.0238	0.0299	**0.0336**
Pb-212	**0.9952**	**0.1804**	**0.3643**	**0.0955**	<MDA	**1.386**
Confidence Interval (± 2 SD)	**0.4561**	**0.0289**	**0.0498**	**0.0237**		**0.1325**
MDA	**0.0419**	**0.0264**	**0.0376**	**0.0235**	0.0348	**0.0466**
Pb-214	**0.6708**	**0.9578**	**2.0180**	**0.5304**	**0.5518**	**0.9427**
Confidence Interval (± 2 SD)	**0.0598**	**0.1021**	**0.1966**	**0.0677**	**0.0487**	**0.0692**
MDA	**0.0612**	**0.0461**	**0.0632**	**0.0412**	**0.0537**	**0.0631**
Ra-226	**2.021**	**2.0430**	**4.2130**	**1.1500**	<MDA	**2.466**
Confidence Interval (± 2 SD)	**0.7041**	**0.6270**	**0.8122**	**0.4345**		**0.6342**
MDA	**0.7067**	**0.5041**	**0.6696**	**0.4141**	0.6208	**0.7927**
Ac-228	**1.0600**	**0.6434**	**1.0460**	**0.4587**	**0.7285**	**1.326**
Confidence Interval (± 2 SD)	**0.0932**	**0.0792**	**0.1144**	**0.0685**	**0.0739**	**0.1624**
MDA	**0.1143**	**0.0793**	**0.1166**	**0.0785**	**0.0916**	**0.1092**
Th-234	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (± 2 SD)						
MDA	0.4519	0.3123	0.5904	0.3734	0.4823	0.4992
Am-241	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (± 2 SD)						
MDA	0.1013	0.0559	0.0777	0.0471	0.0854	0.1116

Note: There were no detections for Be-7, Ce-144, Co-58, Co-60, Cs-134, Eu-152, Eu-154, Eu-155, I-131, Mn-54, Na-22, Ru-103, Sb-125, Y-88, Zn-65, and Zr-95.

Surface Soil Monitoring Data

2007 ESOP Gamma Soil Data SRS Random Perimeter "E" Samples <50 miles

Sample ID	SSE45	SSE46	SSE47	SSE48	SSE49	SSE50
County	HAMPTON	ORANGEBURG	LEXINGTON	ORANGEBURG	ALLENDALE	SALUDA
Collection Date	7/26/2007	7/17/2007	7/19/2007	11/29/2007	11/28/2007	12/18/2007
Analyte and Results	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
K-40	**0.4812**	**1.529**	<MDA	**2.501**	**3.998**	**11.17**
Confidence Interval (± 2 SD)	**0.2190**	**0.4937**		**0.5686**	**0.5759**	**1.071**
MDA	**0.2122**	**0.3690**	0.2782	**0.2784**	**0.3019**	**0.4485**
Cs-137	**0.0623**	**0.1474**	**0.1011**	**0.3557**	**0.4199**	**0.3199**
Confidence Interval (± 2 SD)	**0.0292**	**0.0348**	**0.0354**	**0.0500**	**0.0552**	**0.0448**
MDA	**0.0292**	**0.0452**	**0.0418**	**0.0350**	**0.0368**	**0.0535**
Pb-212	**0.4476**	**1.599**	**2.187**	**1.907**	**1.205**	**1.331**
Confidence Interval (± 2 SD)	**0.0542**	**0.7403**	**0.2034**	**0.9238**	**0.1250**	**0.1387**
MDA	**0.0313**	**0.0531**	**0.0582**	**0.0681**	**0.0714**	**0.0712**
Pb-214	**0.4552**	**2.001**	**1.128**	**1.975**	**2.520**	**2.895**
Confidence Interval (± 2 SD)	**0.0481**	**0.1233**	**0.0847**	**0.1266**	**0.1477**	**0.1756**
MDA	**0.0568**	**0.0948**	**0.0817**	**0.0738**	**0.0781**	**0.1136**
Ra-226	<MDA	**3.820**	**2.357**	**3.818**	**5.358**	**6.553**
Confidence Interval (± 2 SD)		**0.9011**	**0.7098**	**0.8523**	**1.131**	**1.123**
MDA	0.6141	**1.048**	**0.9730**	**0.8520**	**0.8805**	**1.238**
Ac-228	**0.5047**	**1.424**	**2.034**	**1.300**	**1.275**	**1.205**
Confidence Interval (± 2 SD)	**0.0789**	**0.1287**	**0.1647**	**0.1312**	**0.1380**	**0.1679**
MDA	**0.1002**	**0.1637**	**0.1262**	**0.1180**	**0.1332**	**0.1876**
Th-234	<MDA	**5.701**	<MDA	<MDA	<MDA	<MDA
Confidence Interval (± 2 SD)		**2.639**				
MDA	0.5534	**0.9658**	0.9450	2.247	2.246	1.175
Am-241	<MDA	**0.7622**	<MDA	<MDA	<MDA	<MDA
Confidence Interval (± 2 SD)		**0.1784**				
MDA	0.0842	**0.1243**	0.1403	0.6985	0.7160	0.1669

Note: There were no detections for Be-7, Ce-144, Co-58, Co-60, Eu-152, Eu-154, Eu-155, I-131, Mn-54, Na-22, Ru-103, Sb-125, Y-88, Zn-65, and Zr-95.

Surface Soil Monitoring Data

2007 ESOP Gamma Soil Data SRS Random Background "B" Samples <50 miles

Sample ID	SSB37	SSB38	SSB39	SSB40	SSB41	SSB42
County	ABBEVILLE	LAURENS	SALUDA	LAURENS	LEXINGTON	DORCHESTER
Collection Date	3/27/2007	3/27/2007	3/26/2007	4/26/2007	7/19/2007	5/01/2007
Analysis Date	5/02/2007	5/02/2007	5/01/2007	8/02/2007	10/09/2007	8/02/2007
Analyte and Results	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
K-40	**14.2100**	**23.1500**	**4.8240**	**18.15**	<MDA	<MDA
Confidence Interval (± 2 SD)	**1.0380**	**1.5720**	**0.5657**	**1.341**		
MDA	**0.1772**	**0.2387**	**0.2074**	**0.2039**	0.2726	0.2233
Zr-95	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (± 2 SD)						
MDA	0.0570	0.0671	0.0685	0.1457	0.1389	0.0833
Cs-137	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (± 2 SD)						
MDA	0.0241	0.0291	0.0312	0.0339	0.0400	0.0208
Pb-212	**0.1223**	**0.1679**	**0.1543**	**0.5407**	**1.490**	**0.2780**
Confidence Interval (± 2 SD)	**0.0323**	**0.0296**	**0.0337**	**0.0629**	**0.1414**	**0.0388**
MDA	**0.0236**	**0.0295**	**0.0291**	**0.0371**	**0.0479**	**0.0325**
Pb-214	**0.4096**	**0.6768**	**0.6482**	**0.4580**	**1.027**	**0.2133**
Confidence Interval (± 2 SD)	**0.0578**	**0.0812**	**0.0834**	**0.0568**	**0.0767**	**0.0286**
MDA	**0.0394**	**0.0466**	**0.0475**	**0.0616**	**0.0693**	**0.0383**
Ra-226	**0.9265**	**1.9050**	**1.3490**	<MDA	**2.039**	<MDA
Confidence Interval (± 2 SD)	**0.4356**	**0.6953**	**0.6148**		**0.5961**	
MDA	**0.4418**	**0.5117**	**0.5335**	0.6289	**0.7916**	0.4232
Ac-228	<MDA	**0.6959**	**0.5984**	**0.5528**	**1.500**	<MDA
Confidence Interval (± 2 SD)		**0.0960**	**0.0932**	**0.0810**	**0.1312**	
MDA	0.1563	**0.1023**	**0.1018**	**0.1146**	**0.1145**	0.1094
Th-234	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Confidence Interval (± 2 SD)						
MDA	0.3642	0.3447	0.3610	0.4129	0.8995	0.3976

Note: There were no detections for Am-241, Be-7, Ce-144, Co-58, Co-60, Cs-134, Eu-152, Eu-154, Eu-155, I-131, Mn-54, Na-22, Ru-103, Sb-125, Y-88, Zn-65, and Zr-95.

Surface Soil Monitoring Data

2007 ESOP Gamma Soil Data SRS Random Background "B" Samples <50 miles

Sample ID	SSB43	SSB44	SSB45	SSB46	SSB47	SSB48
County	ORANGEBURG	ORANGEBURG	ANDERSON	OCONEE	LAURENS	DORCHESTER
Collection Date	7/31/2007	8/17/2007	8/6/2007	12/17/2007	12/21/2007	12/4/2007
Analysis Date	10/10/2007	10/12/2007	10/10/2007	3/26/2008	2/28/2008	3/21/2008
Analyte and Results	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
K-40	**0.5950**	<MDA	**10.37**	**17.51**	**14.62**	**1.542**
Confidence Interval (± 2 SD)	**0.2355**		**0.9474**	**1.463**	**1.260**	**0.4668**
MDA	**0.1714**	0.2608	**0.3866**	**0.3014**	**0.4188**	**0.2465**
Zr-95	<MDA	<MDA	<MDA	<MDA	**0.8942**	<MDA
Confidence Interval (± 2 SD)					**0.2172**	
MDA	0.0805	0.1021	0.1744	0.1699	**0.2191**	0.1651
Cs-137	<MDA	**0.2055**	**0.3548**	**0.5159**	**0.5831**	**0.4162**
Confidence Interval (± 2 SD)		**0.0378**	**0.0448**	**0.0615**	**0.0821**	**0.0595**
MDA	0.0248	**0.0339**	**0.0492**	**0.0366**	**0.0603**	**0.0330**
Pb-212	<MDA	<MDA	**2.048**	**1.044**	**2.729**	<MDA
Confidence Interval (± 2 SD)			**0.1951**	**0.1097**	**0.2570**	
MDA	0.0306	0.0379	**0.0558**	**0.0624**	**0.0736**	0.0581
Pb-214	**0.3866**	**0.7851**	**1.519**	**0.8929**	**1.750**	**0.9406**
Confidence Interval (± 2 SD)	**0.0464**	**0.0757**	**0.1073**	**0.0912**	**0.1261**	**0.0880**
MDA	**0.0490**	**0.0687**	**0.1031**	**0.0716**	**0.1166**	**0.0675**
Ra-226	<MDA	**1.773**	**4.062**	**2.39**	**4.284**	**1.818**
Confidence Interval (± 2 SD)		**0.5548**	**1.108**	**0.7349**	**1.134**	**0.7495**
MDA	0.5384	**0.7774**	**1.102**	**0.7751**	**1.234**	**0.7310**
Ac-228	**0.5816**	**0.7074**	**2.240**	**1.158**	**2.557**	**0.6731**
Confidence Interval (± 2 SD)	**0.0709**	**0.1023**	**0.1885**	**0.1280**	**0.2038**	**0.1001**
MDA	**0.0768**	**0.1133**	**0.1632**	**0.1318**	**0.2004**	**0.1088**
Th-234	<MDA	**3.870**	**2.526**	<MDA	<MDA	<MDA
Confidence Interval (± 2 SD)		**1.840**	**1.219**			
MDA	0.5128	**0.6928**	**1.018**	2.070	1.345	1.870

Note: There were no detections for Am-241, Be-7, Ce-144, Co-58, Co-60, Cs-134, Eu-152, Eu-154, Eu-155, I-131, Mn-54, Na-22, Ru-103, Sb-125, Y-88, Zn-65, and Zr-95.

Surface Soil Monitoring Data

2007 ESOP Metals Analysis of Surface Soils **Nonrandom Perimeter Samples**

Sample Location:	SSAIK001	SSAIK002	SSAIK003	SSAIK004	SSAIK005	SSAIK007
County	AIKEN	AIKEN	AIKEN	AIKEN	AIKEN	AIKEN
Collection Date	6/5/2007	6/5/2007	7/13/2007	8/14/2007	8/16/2007	12/28/2007
Analyte and Results	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	**2500**	**2500**	**11000**	**2000**	**5200**	**1800**
Barium	**10**	<5.0	**140**	**8.8**	**16**	**7.6**
Beryllium	<0.30	<0.30	**0.65**	<0.30	<0.30	<0.30
Boron	<10	<10	<10	<10	<10	**38**
Cadmium	<1.0	<1.0	**1.9**	<1.0	<1.0	<1.0
Cobalt	<2.0	<2.0	**11**	<2.0	<2.0	<2.0
Chromium	**2.6**	**5.2**	**18**	**4.3**	**6.4**	**4.3**
Copper	**1.1**	**1.4**	**13**	**1.3**	**1.7**	<1.0
Iron	**1600**	**3200**	**16000**	**1300**	**4800**	**2400**
Mercury	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium	**85**	**30**	**1600**	**150**	**100**	**44**
Manganese	**34**	**2.0**	**1000**	**10**	**51**	**53**
Molybdenum	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel	<2.0	<2.0	**7.5**	<2.0	<2.0	<2.0
Lead	<5.0	<5.0	**11**	<5.0	<5.0	**6.6**
Titanium	**52**	**38**	**440**	**83**	**61**	**41**
Vanadium	**3.9**	**7.8**	**32**	**6.2**	**12**	**6.4**
Zinc	**3.6**	**1.6**	**46**	**4.0**	**6.2**	**6.0**

Sample Location:	SSALD001	SSALD003	SSALD004	SSBWL001	SSBWL002	SSBWL003
County	ALLENDALE	ALLENDALE	ALLENDALE	BARNWELL	BARNWELL	BARNWELL
Collection Date	8/20/2007	11/28/2007	11/28/2007	6/5/2007	6/20/2007	6/20/07
Analyte and Results	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	**70000**	**10000**	**5400**	**2800**	**1700**	**4000**
Barium	**170**	**39**	**23**	**11**	**13**	**22**
Beryllium	**0.88**	<0.30	<0.30	<0.30	<0.30	<0.30
Boron	<10	<10	<10	<10	<10	<10
Cadmium	**3.1**	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt	**13**	<2.0	<2.0	<2.0	<2.0	<2.0
Chromium	**28**	**7.3**	**4.3**	**7.1**	**3.0**	**3.4**
Copper	**20**	**1.8**	<1.0	<1.0	**1.4**	<1.0
Iron	**66000**	**9000**	**3200**	**520**	**1500**	**3700**
Mercury	**0.10**	**0.11**	<0.10	<0.10	<0.10	<0.10
Magnesium	**1100**	**220**	**100**	**59**	**29**	**110**
Manganese	**970**	**240**	**32**	**2.8**	**28**	**14**
Molybdenum	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel	**8.1**	**2.3**	<2.0	<2.0	<2.0	<2.0
Lead	**36**	**13**	**12**	<5.0	<5.0	<5.0
Titanium	**330**	**43**	**61**	**48**	**30**	**31**
Vanadium	**61**	**16**	**7.3**	**2.6**	**2.8**	**5.9**
Zinc	**47**	**10**	**2.5**	**1.9**	**4**	**3.3**

Notes: There were no detections for silver, arsenic, antimony, selenium, tin or thallium.

Surface Soil Monitoring Data

2007 ESOP Metals Analysis of Surface Soils **Nonrandom Background Samples**

Sample Location:	SSMCK001	SSMCK002	SSEFD001	SSSAL001	SSAND001	SSDAR001
County	MCCORMICK	MCCORMICK	EDGEFIELD	SALUDA	ANDERSON	DARLINGTON
Collection Date	6/25/2007	6/25/2007	6/25/2007	6/25/2007	8/6/2007	8/21/2007
Analyte and Results	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	**13000**	**9400**	**8900**	**7200**	**150000**	**3800**
Barium	**120**	**67**	**75**	**50**	**110**	**25**
Beryllium	**0.55**	**0.34**	**0.39**	**0.36**	**0.63**	<0.30
Boron	<10	<10	<10	<10	<10	<10
Cadmium	**2.3**	**1.9**	**1.8**	**1.2**	**1.7**	<1.0
Cobalt	**11**	**9.9**	**8.4**	**6.9**	**8.1**	<2.0
Chromium	**10**	**15**	**14**	**18**	**17**	**4.1**
Copper	**12**	**9**	**9.1**	**7.3**	**6.5**	**5.4**
Iron	**19000**	**15000**	**15000**	**10000**	**19000**	**3800**
Mercury	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium	**1700**	**650**	**1600**	**670**	**1900**	**180**
Manganese	**1000**	**680**	**590**	**270**	**680**	**71**
Molybdenum	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel	**7.8**	**6.2**	**7.3**	**10**	**10**	<2.0
Lead	**14**	**9.2**	**10**	**7.4**	**13**	**10**
Titanium	**300**	**120**	**190**	**160**	**750**	**41**
Vanadium	**27**	**39**	**24**	**22**	**34**	**8.3**
Zinc	**92**	**14**	**24**	**14**	**42**	**27**

Sample Location:	SSGRN001	SSNEW001	SSCOL001	SSBER001	SSCLA001	SSCAL001
County	GREENWOOD	NEWBERRY	COLLETON	BERKELEY	CLARENDON	CALHOUN
Collection Date	8/23/2007	8/23/2007	12/4/2007	12/11/2007	12/16/2007	12/16/2007
Analyte and Results	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	**14000**	**140000**	**6600**	**36000**	**5100**	**2400**
Barium	**52**	**140**	**43**	**130**	**26**	**16**
Beryllium	**0.47**	**0.98**	**0.34**	<0.30	<0.30	<0.30
Boron	<10	<10	<10	<10	<10	<10
Cadmium	**3.1**	**3.8**	**2.3**	**16**	<1.0	<1.0
Cobalt	**15**	**12**	<2.0	**9.5**	<2.0	<2.0
Chromium	**27**	**28**	**14**	**28**	**8.3**	**2.0**
Copper	**20**	**22**	**4.6**	**24**	<1.0	**1.5**
Iron	**62000**	**280000**	**4300**	**20000**	**2600**	**1500**
Mercury	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium	**510**	**4000**	**190**	**1200**	**110**	**70**
Manganese	**770**	**500**	**6.0**	**310**	**46**	**94**
Molybdenum	<2.0	<2.0	<2.0	<2.0	**2.6**	<2.0
Nickel	**7.3**	**12**	**2.1**	**11**	<2.0	<2.0
Lead	**13**	**21**	**11**	**42**	**6.7**	<5.0
Titanium	**340**	**1500**	**73**	**500**	**45**	**22**
Vanadium	**89**	**82**	**13**	**66**	**8.8**	**6.8**
Zinc	**18**	**57**	**10**	**48**	**10**	**2.9**

Notes: There were no detections for silver, arsenic, antimony, selenium, tin or thallium.

Surface Soil Monitoring Data

2007 ESOP Metals Analysis of Surface Soils **Random Perimeter Samples**

Sample Location:	SSE39	SSE40	SSE41	SSE42	SSE43	SSE44
County	ALLENDALE	BARNWELL	AIKEN	SALUDA	BAMBERG	ALLENDALE
Collection Date	5/09/2007	3/29/2007	3/22/2007	3/26/2007	5/24/2007	5/09/2007
Analyte and Results	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	**1100**	**2600**	**12000**	**2900**	**3500**	**3000**
Barium	<5.0	**13**	**110**	**28**	**7.4**	**7.7**
Beryllium	<0.30	<0.30	0.36	<0.30	<0.30	<0.30
Boron	<10	<10	<10	<10	<10	<10
Cadmium	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt	<2.0	<2.0	<2.0	3.2	<2.0	<2.0
Chromium	**1.7**	**5**	**19**	**4.7**	**5.4**	**3.5**
Copper	<1.0	**2.1**	**8**	**2.4**	<1.0	<1.0
Iron	**880**	**1600**	**9800**	**3600**	**4000**	**1800**
Mercury	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium	**22**	**39**	**220**	**300**	**65**	**64**
Manganese	**36**	**25**	**52**	**200**	**12**	**6.8**
Molybdenum	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel	<2.0	<2.0	**2.8**	<2.0	<2.0	<2.0
Lead	<5.0	**36**	**40**	**5.3**	<5.0	<5.0
Titanium	**22**	**45**	**97**	**120**	**49**	**44**
Vanadium	**2.4**	**3**	**24**	**6.7**	**10**	**5.1**
Zinc	**1.1**	**5**	**14**	**10**	**1.6**	**2.4**

Sample Location:	SSE45	SSE46	SSE47	SSE48	SSE49	SSE50
County	HAMPTON	ORANGEBURG	LEXINGTON	ORANGEBURG	ALLENDALE	SALUDA
Collection Date	7/26/2007	7/17/2007	7/19/2007	11/29/2007	11/28/2007	12/18/2007
Analyte and Results	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	**2800**	**4700**	**2500**	**10000**	**1000**	**5900**
Barium	**12**	**19**	<5.0	**58**	**7.9**	**93**
Beryllium	<0.30	<0.30	<0.30	**0.32**	<0.30	**0.38**
Boron	<10	<10	<10	<10	<10	**150**
Cadmium	<1.0	<1.0	<1.0	<1.0	<1.0	**1.1**
Cobalt	<2.0	<2.0	<2.0	<2.0	<2.0	**6.4**
Chromium	**2.0**	**20**	**4.7**	**7.6**	**4.3**	**8.0**
Copper	<1.0	**2.4**	**1.8**	**1.3**	<1.0	<1.0
Iron	**1300**	**1500**	**1300**	**5700**	**680**	**11000**
Mercury	<0.10	<0.10	<0.10	<0.10	**0.14**	<0.10
Magnesium	**78**	**100**	**45**	**220**	**46**	**591**
Manganese	**15**	**14**	**3.5**	**32**	**38**	**1300**
Molybdenum	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel	<2.0	<2.0	<2.0	**2.6**	<2.0	**3.3**
Lead	<5.0	**7.2**	<5.0	**13**	**5.3**	**16**
Titanium	**48**	**43**	**77**	**35**	**90**	**79**
Vanadium	**3.3**	**6.1**	**5.5**	**12**	<2.0	**16**
Zinc	**3.1**	**7.4**	**4.4**	**10**	**4.6**	**13**

Notes:There were no detections for silver, arsenic, antimony, selenium, tin or thallium.

Surface Soil Monitoring Data

2007 ESOP Metals Analysis of Surface Soils **Random Background Samples**

Sample Location:	SSB37	SSB38	SSB39	SSB40	SSB41	SSB42
County	ABBEVILLE	LAURENS	SALUDA	LAURENS	LEXINGTON	DORCHESTER
Collection Date	3/27/2007	3/27/2007	3/26/2007	4/26/2007	7/19/2007	5/01/2007
Analyte and Results	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	**3100**	**4000**	**9200**	**1300**	**2300**	**3800**
Barium	**36**	**18**	**86**	**120**	**7.6**	<5.0
Beryllium	<0.30	**0.33**	**0.64**	<0.30	<0.30	<0.30
Boron	<10	<10	<10	<10	<10	<10
Cadmium	<1.0	<1.0	<1.0	<1.0	<1.0	**1.3**
Cobalt	**3.7**	**2.3**	**16**	**3.0**	<2.0	<2.0
Chromium	**3.8**	**2.6**	**32**	**5.8**	**2.3**	**23**
Copper	**3.1**	**1.9**	**13**	<1.0	<1.0	<1.0
Iron	**3600**	**4600**	**26000**	**3700**	**1100**	**12000**
Mercury	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium	**320**	**510**	**1500**	**210**	**73**	**10**
Manganese	**380**	**100**	**1000**	**290**	**14**	<1.0
Molybdenum	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel	<2.0	<2.0	**8.9**	<2.0	<2.0	<2.0
Lead	<5.0	**6.5**	**20**	<5.0	<5.0	<5.0
Titanium	**120**	**240**	**160**	**110**	**98**	**26**
Vanadium	**7.8**	**3.4**	**31**	**7.9**	**3.4**	**16**
Zinc	**7.2**	**9.2**	**29**	**2.8**	**3.1**	**2.1**

Sample Location:	SSB43	SSB44	SSB45	SSB46	SSB47	SSB48
County	ORANGEBURG	ORANGEBURG	ANDERSON	OCONEE	LAURENS	DORCHESTER
Collection Date	7/31/2007	8/17/2007	8/6/2007	12/17/2007	12/21/2007	12/4/2007
Analyte and Results	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	**2000**	**5500**	**56000**	**16000**	**8600**	**4000**
Barium	**7.1**	**14**	**120**	**150**	**109**	**24**
Beryllium	<0.30	<0.30	**0.80**	<0.30	**0.36**	<0.30
Boron	<10	<10	<10	<10	**250**	<10
Cadmium	<1.0	<1.0	**2.0**	**19**	**2.1**	<1.0
Cobalt	<2.0	<2.0	**8.7**	**17**	**8.7**	<2.0
Chromium	**3.8**	**7.1**	**27**	**17**	**14**	**4.1**
Copper	<1.0	**1.2**	**13**	**12**	<1.0	<1.0
Iron	**2400**	**3800**	**30000**	**31000**	**21000**	**2000**
Mercury	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium	**72**	**180**	**1600**	**3900**	**1100**	**170**
Manganese	**10**	**18**	**120**	**310**	**1600**	**100**
Molybdenum	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel	<2.0	<2.0	**14**	**12**	**3.9**	<2.0
Lead	<5.0	**7.4**	**20**	**8.0**	**27**	**15**
Titanium	**74**	**44**	**900**	**1800**	**380**	**42**
Vanadium	**9.0**	**10**	**57**	**50**	**32**	**5.5**
Zinc	**2.4**	**9.2**	**43**	**53**	**26**	**7.7**

Notes: There were no detections for silver, arsenic, antimony, selenium, tin or thallium.

Surface Soil Monitoring Data

2007 ESOP Metals Analysis of Surface Soils **Savannah River Riverbank Soil**

Sample ID	SS 301SC 001	SS 301GA 001	SS LHL 001	SS SCL 001	SS JBL 001
Location Name	301 Bridge	Burton's Ferry	Little Hell	Steel Creek Landing	Jackson Boat Landing
County	Allendale	Screven	Allendale	Barnwell	Aiken
Collection Date	12/27/2007	12/27/2007	12/27/2007	12/27/2007	12/27/2007
Analyte and Results	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	**4400**	**5100**	**460**	**8300**	**7200**
Barium	**44**	**64**	<5.0	**62**	**80**
Beryllium	<0.30	<0.30	<0.30	<0.30	<0.30
Boron	**136**	**160**	**11**	**230**	**190**
Cadmium	**1.1**	**1.2**	<1.0	**1.7**	**1.4**
Cobalt	**4.5**	**5.7**	<2.0	**6.7**	**5.9**
Chromium	**9.7**	**11**	<1.0	**17**	**14**
Copper	<1.0	<1.0	<1.0	<1.0	<1.0
Iron	**9200**	**11000**	**660**	**16000**	**14000**
Mercury	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium	**1100**	**1100**	**38**	**1400**	**1300**
Manganese	**270**	**390**	**14**	**570**	**540**
Molybdenum	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel	**3.3**	**3.8**	<2.0	**4.3**	**4.0**
Lead	**28**	**11**	<5.0	**15**	**15**
Titanium	**360**	**380**	**30**	**480**	**420**
Vanadium	**16**	**19**	**<2.0**	**27**	**26**
Zinc	**21**	**23**	**2.6**	**22**	**22**

Notes: There were no detections for silver, arsenic, antimony, selenium, tin or thallium.

Back to List of Data Tables

3.1.5 Summary Statistics

Surface Soil Monitoring

2007 Radiological Statistics.....240

2007 Nonradionuclides Statistics.....243

Notes:

1. N/A = Not Applicable
2. Min. – Minimum
3. Max. = Maximum

Back to List of Statistical Summaries

Surface Soil Monitoring

Summary Statistics (Detects Only)
2007 ESOP Nonrandom Surface Soil Radiological Data
Perimeter Samples (<50 miles)

	Average	Standard Deviation	Median	Min.	Max.
K-40	4.008	5.351	1.178	0.5102	14.42
Cs-137	2.026	5.496	0.199	0.0875	16.68
Pb-212	1.489	0.383	1.397	1.115	2.197
Pb-214	1.328	0.620	1.270	0.5110	2.352
Ra-226	2.694	1.150	2.429	1.018	5.219
Ac-228	1.337	0.456	1.292	0.6190	2.190
Th-234	5.166	2.398	5.166	3.470	6.861
Am-241	0.267	N/A	0.267	0.2669	0.2669
Alpha	N/A	N/A	N/A	N/A	N/A
Beta	20.50	9.39	25.0	9.7	26.8

Surface Soil Monitoring

Summary Statistics (Detects Only)
2007 ESOP Nonrandom Surface Soil Radiological Data
Background Samples (>50 miles)

	Average	Standard Deviation	Median	Min.	Max.
K-40	7.193	4.972	6.543	0.578	16.190
Zr-95	0.487	N/A	0.487	0.487	0.487
Cs-137	0.232	0.188	0.177	0.089	0.719
Pb-212	1.048	0.505	0.853	0.416	1.930
Pb-214	1.061	0.602	0.898	0.577	2.740
Ra-226	2.108	1.230	2.084	0.195	4.512
Ac-228	1.014	0.405	0.901	0.508	1.795
Am-241	0.435	0.157	0.435	0.324	0.546
Alpha	25.4	1.84	25.4	24.1	26.7
Beta	16.86	7.96	15.9	7.8	29.7

Summary Statistics (Detects Only)
2007 ESOP Random Surface Soil Radiological Data
Perimeter Samples (<50 miles)

	Average	Standard Deviation	Median	Min.	Max.
K-40	2.802	3.313	1.529	0.4812	11.17
Cs-137	0.212	0.142	0.147	0.0623	0.4199
Pb-212	0.972	0.737	0.995	0.0955	2.187
Pb-214	1.387	0.850	1.043	0.4552	2.895
Ra-226	3.380	1.685	3.142	1.1500	6.553
Ac-228	1.084	0.450	1.133	0.4587	2.034
Th-234	5.701	N/A	5.701	5.701	5.701
Am-241	0.762	N/A	0.762	0.7622	0.7622
Alpha	28.67	9.51	26.1	20.7	39.2
Beta	16.1	N/A	16.1	16.1	16.1

Surface Soil Monitoring

Summary Statistics (Detects Only)
2007 ESOP Random Surface Soil Radiological Data
Background Samples (>50 miles)

	Average	Standard Deviation	Median	Min.	Max.
K-40	10.497	7.881	14.210	0.5950	23.1500
Zr-95	0.894	N/A	0.894	0.8942	0.8942
Cs-137	0.415	0.147	0.416	0.2055	0.5831
Pb-212	0.953	0.950	0.541	0.1223	2.729
Pb-214	0.809	0.459	0.731	0.2133	1.750
Ra-226	2.283	1.150	1.905	0.9265	4.284
Ac-228	1.126	0.738	0.702	0.5528	2.557
Th-234	3.198	0.950	3.198	2.526	3.870
Alpha	18.2	N/A	18.2	18.2	18.2
Beta	16.35	3.07	15.4	14.0	20.7

Summary Statistics (Detects Only)
2007 ESOP Random Riverbank Soil Radiological Data
Savannah River Boat Landing Riverbank Soil

	Average	Standard Deviation	Median	Min.	Max.
K-40	12.618	5.144	15.130	3.909	16.32
Cs-137	0.633	0.822	0.342	0.0675	2.088
Pb-212	1.332	0.228	1.332	1.1700	1.493
Pb-214	1.138	0.455	1.287	0.3354	1.455
Ra-226	2.689	0.990	3.025	0.9571	3.358
Ac-228	1.161	0.370	1.321	0.5187	1.403
Th-234	1.299	N/A	1.299	1.2990	1.2990
Alpha	N/A	N/A	N/A	N/A	N/A
Beta	15.63	2.53	16.05	12.20	18.20

Surface Soil Monitoring

Summary Statistics (Detects Only)
2007 ESOP Surface Soil Metals Statistical Data for All Perimeter Samples (<50 Miles)

	Average	Standard Deviation	Median	Min.	Max.	No. of Detects	Total Sampled
Aluminum	6771.03	12555.65	3500.00	460	70000	29	29
Barium	42.66	44.88	22.00	7.4	170	25	29
Beryllium	0.52	0.24	0.38	0.32	0.88	5	29
Boron	130.71	79.12	150.00	11	230	7	29
Cadmium	1.64	0.71	1.40	1.1	3.1	7	29
Cobalt	7.05	3.30	6.15	3.2	13	8	29
Chromium	8.27	6.58	5.30	1.7	28	28	29
Copper	4.26	5.63	1.80	1.1	20	14	29
Iron	7146.21	12292.55	3200.00	520	66000	29	29
Mercury	0.12	0.02	0.11	0.1	0.14	3	29
Magnesium	357.07	493.82	100.00	22	1600	29	29
Manganese	205.35	346.60	34.00	2	1300	29	29
Molybdenum	N/A	N/A	N/A	N/A	N/A	0	29
Nickel	4.20	2.00	3.55	2.3	8.1	10	29
Lead	16.90	11.51	13.00	5.3	40	16	29
Titanium	126.79	146.44	52.00	22	480	29	29
Vanadium	12.81	12.76	7.30	2.4	61	27	29
Zinc	10.46	12.02	5.00	1.1	47	29	29

Surface Soil Monitoring

Summary Statistics (Detects Only)
2007 ESOP Surface Soil Metals Statistical Data for All Background Samples (>50 Miles)

	Average	Standard Deviation	Median	Min.	Max.	No. of Detects	Total Sampled
Aluminum	21341.67	39992.86	6900.00	1300	150000	24	24
Barium	67.20	48.11	52.00	7.1	150	23	24
Beryllium	0.52	0.21	0.43	0.33	0.98	12	24
Boron	250.00	N/A	250.00	N/A	250	1	24
Cadmium	4.68	6.06	2.05	1.2	19	12	24
Cobalt	9.35	4.44	8.70	2.3	17	15	24
Chromium	13.66	9.66	14.00	2	32	24	24
Copper	9.74	7.07	9.00	1.2	24	17	24
Iron	24725.00	56137.00	11000.00	1100	280000	24	24
Mercury	N/A	N/A	N/A	N/A	N/A	0	24
Magnesium	934.38	1112.62	510.00	10	4000	24	24
Manganese	389.52	411.80	290.00	6	1600	23	24
Molybdenum	2.60	N/A	2.60	N/A	2.6	1	24
Nickel	8.65	3.37	8.90	2.1	14	13	24
Lead	14.51	8.97	12.00	6.5	42	18	24
Titanium	334.79	465.66	140.00	22	1800	24	24
Vanadium	27.20	25.03	19.00	3.4	89	24	24
Zinc	23.07	22.58	14.00	2.1	92	24	24

Surface Soil Monitoring

Summary Statistics (Detects Only)
2007 ESOP Surface Soil Metals Statistical Data for Random Perimeter Samples (<50 Miles)

	Average	Standard Deviation	Median	Min.	Max.	No. of Detects	Total Sampled
Aluminum	4333.33	3415.03	2950	1000	12000	12	12
Barium	35.60	38.11	16	7.4	110	10	12
Beryllium	0.35	0.03	0.36	0.32	0.38	3	12
Boron	150.00	N/A	150	150	150	1	12
Cadmium	1.10	N/A	1.1	1.1	1.1	1	12
Cobalt	4.80	2.26	4.8	3.2	6.4	2	12
Chromium	7.16	6.06	4.85	1.7	20	12	12
Copper	3.00	2.48	2.25	1.3	8	6	12
Iron	3596.67	3515.22	1700	680	11000	12	12
Mercury	0.14	N/A	0.14	0.14	0.14	1	12
Magnesium	149.17	165.04	71.5	22	591	12	12
Manganese	144.53	367.68	28.5	3.5	1300	12	12
Molybdenum	N/A	N/A	N/A	N/A	N/A	0	12
Nickel	2.90	0.36	2.8	2.6	3.3	3	12
Lead	17.54	14.58	13	5.3	40	7	12
Titanium	62.42	29.47	48.5	22	120	12	12
Vanadium	8.55	6.60	6.1	2.4	24	11	12
Zinc	6.38	4.43	4.8	1.1	14	12	12

Summary Statistics (Detects Only)
2007 ESOP Surface Soil Metals Statistical Data for Nonrandom Perimeter Samples (<50 Miles)

	Average	Standard Deviation	Median	Min.	Max.	No. of Detects	Total Sampled
Aluminum	9908.33	19177.57	3400	1700	70000	12	12
Barium	41.85	57.05	16	7.6	170	11	12
Beryllium	0.77	0.16	0.765	0.65	0.88	2	12
Boron	38.00	N/A	38	38	38	1	12
Cadmium	2.50	0.85	2.5	1.9	3.1	2	12
Cobalt	12.00	1.41	12	11	13	2	12
Chromium	7.83	7.55	4.75	2.6	28	12	12
Copper	5.21	7.22	1.55	1.1	20	8	12
Iron	9435.00	18326.61	3200	520	66000	12	12
Mercury	0.11	0.01	0.105	0.1	0.11	2	12
Magnesium	302.25	503.72	100	29	1600	12	12
Manganese	203.07	370.79	33	2	1000	12	12
Molybdenum	N/A	N/A	N/A	N/A	N/A	0	12
Nickel	5.97	3.19	7.5	2.3	8.1	3	12
Lead	15.72	11.60	12	6.6	36	5	12
Titanium	104.83	133.75	50	30	440	12	12
Vanadium	13.66	16.96	6.85	2.6	61	12	12
Zinc	11.34	16.58	4	1.6	47	12	12

Surface Soil Monitoring

Summary Statistics (Detects Only)
2007 ESOP Surface Soil Metals Statistical Data for Riverbank Soil (<50 Miles)

	Average	Standard Deviation	Median	Min.	Max.	No. of Detects	Total Sampled
Aluminum	5092.00	3027.76	5100	460	8300	5	5
Barium	62.50	14.73	63	44	80	4	5
Beryllium	N/A	N/A	N/A	N/A	N/A	0	5
Boron	145.40	82.93	160	11	230	5	5
Cadmium	1.35	0.26	1.3	1.1	1.7	4	5
Cobalt	5.70	0.91	5.8	4.5	6.7	4	5
Chromium	12.93	3.26	12.5	9.7	17	4	5
Copper	N/A	N/A	N/A	N/A	N/A	0	5
Iron	10172.00	5931.43	11000	660	16000	5	5
Mercury	N/A	N/A	N/A	N/A	N/A	0	5
Magnesium	987.60	546.51	1100	38	1400	5	5
Manganese	356.80	226.48	390	14	570	5	5
Molybdenum	N/A	N/A	N/A	N/A	N/A	0	5
Nickel	3.85	0.42	3.9	3.3	4.3	4	5
Lead	17.25	7.41	15	11	28	4	5
Titanium	334.00	176.01	380	30	480	5	5
Vanadium	22.00	5.35	22.5	16	27	4	5
Zinc	18.12	8.70	22	2.6	23	5	5

Summary Statistics (Detects Only)
2007 ESOP Surface Soil Metals Statistical Data for Random Background Samples (>50 Miles)

	Average	Standard Deviation	Median	Min.	Max.	No. of Detects	Total Sampled
Aluminum	9650.00	15166.98	4000	1300	56000	12	12
Barium	62.88	54.39	36	7.1	150	11	12
Beryllium	0.53	0.23	0.5	0.33	0.8	4	12
Boron	250.00	N/A	250	250	250	1	12
Cadmium	6.10	8.61	2.05	1.3	19	4	12
Cobalt	8.49	6.06	8.7	2.3	17	7	12
Chromium	11.88	10.52	6.45	2.3	32	12	12
Copper	7.37	5.85	7.55	1.2	13	6	12
Iron	11766.67	11808.19	4200	1100	31000	12	12
Mercury	N/A	N/A	N/A	N/A	N/A	0	12
Magnesium	803.75	1126.39	265	10	3900	12	12
Manganese	358.36	500.69	120	10	1600	11	12
Molybdenum	N/A	N/A	N/A	N/A	N/A	0	12
Nickel	9.70	4.40	10.45	3.9	14	4	12
Lead	14.84	7.88	15	6.5	27	7	12
Titanium	332.83	521.73	115	26	1800	12	12
Vanadium	19.42	18.64	9.5	3.4	57	12	12
Zinc	16.23	17.38	8.45	2.1	53	12	12

Surface Soil Monitoring

Summary Statistics (Detects Only)
2007 ESOP Surface Soil Metals Statistical Data for Nonrandom Background Samples (>50 Miles)

	Average	Standard Deviation	Median	Min.	Max.	No. of Detects	Total Sampled
Aluminum	33033.33	53065.80	9150	2400	150000	12	12
Barium	71.17	43.64	59.5	16	140	12	12
Beryllium	0.51	0.22	0.43	0.34	0.98	8	12
Boron	N/A	N/A	N/A	N/A	N/A	0	12
Cadmium	3.98	4.93	2.1	1.2	16	8	12
Cobalt	10.10	2.56	9.7	6.9	15	8	12
Chromium	15.45	8.80	14.5	2	28	12	12
Copper	11.04	7.59	9	1.5	24	11	12
Iron	37683.33	77996.23	15000	1500	280000	12	12
Mercury	N/A	N/A	N/A	N/A	N/A	N/A	12
Magnesium	1065.00	1132.43	660	70	4000	12	12
Manganese	418.08	330.74	405	6	1000	12	12
Molybdenum	2.60	N/A	2.6	2.6	2.6	1	12
Nickel	8.19	2.99	7.8	2.1	12	9	12
Lead	14.30	9.97	11	6.7	42	11	12
Titanium	336.75	425.65	175	22	1500	12	12
Vanadium	34.99	28.82	25.5	6.8	89	12	12
Zinc	29.91	25.72	21	2.9	92	12	12

Back to List of Statistical Summaries

3.2 Radiological Monitoring of Terrestrial Vegetation

3.2.1 Summary

Terrestrial vegetation, fungi, lichens, mosses, etc., can be contaminated externally by direct deposition of airborne materials, water runoff, and precipitation that contains radioactivity. Vegetation can also be contaminated internally by uptake of radionuclides through the roots. Contaminated vegetation can be transported by physical means and, if eaten by animals, this radioactivity can enter the food chain. As with all ionizing radiation, exposure to tritium and cesium-137 (Cs-137) can increase the risk of developing cancer. The Department of Energy-Savannah River (DOE-SR) contracts for the collection and analysis of terrestrial vegetation, primarily Bermuda grass, to determine concentrations of radionuclides (WSRC 2008a).

The Environmental Surveillance and Oversight Program (ESOP) of the South Carolina Department of Health and Environmental Control (SCDHEC) monitors for the presence of radionuclides in vegetation around the SRS. In 2007, ESOP conducted independent vegetation monitoring at 17 locations around the perimeter of the SRS; three former SRS monitoring locations 25 miles from the center of SRS; and 24 locations selected at random (12 near SRS and 12 background sites around South Carolina). Sampling was performed quarterly in February, May, August, and November. Perimeter stations sampled in 2007 are shown in Section 3.2.2.

Samples from 16 perimeter stations were analyzed for tritium activity, all of which exhibited tritium levels greater than the Lower Limit of Detection. Average activity levels were fairly uniform around SRS, with the highest activity located on the western side. Vegetation was collected for gamma analysis at eight selected perimeter stations where sampling had consistently shown detectable levels of cesium-137 (Cs-137), and one station added in 2005. Cesium-137 was detected at all but one of these locations, with the highest activities from stations on the northern side of the SRS. Both tritium and Cs-137 results are consistent with historical findings.

ESOP data supports the Department of Energy-Savannah River (DOE-SR) conclusion that elevated tritium levels in vegetation at and near the site perimeter are due to atmospheric releases from SRS, although Plant Vogtle, a commercial nuclear power plant across the Savannah River from SRS, may also have an effect. The DOE-SR program detected tritium from four stations, while tritium was detected in samples from all 16 stations by the ESOP program. Cesium-137 was detected from six of twelve locations sampled by DOE-SR, and from eight of nine locations sampled by ESOP. It appears that sampling of broadleaf vegetation may be a better indicator of radionuclide occurrence around the SRS perimeter.

Precedence for the monitoring of fungi was established at the Savannah River Plant when mushroom samples were found to contain 2 to 540 picocuries per gram (pCi/g) of Cs-137 in 1983, and 19 to 640 pCi/g in 1984 at locations within SRS (DuPont 1984). The abundance of mushrooms may be related to weather factors and could explain some Cs-137 concentration variations in deer and hogs. The Cs-137 contribution to food dose in humans was over one hundred times greater for fungi than the next largest food source (berries) at Chernobyl (Botsch 1999).

ESOP added fungi sampling to the vegetation project in 2004. Evidence from European studies of the Chernobyl meltdown radioactive releases indicated that mainly bolete fungi are the greatest bio-concentrators of many radionuclides. Also, a DOE-SR survey of fungi noted that Cs-137 concentration fluctuation in deer may be related to the availability of fungi. Fungi were collected at 22 random and 18 nonrandom locations in 2007.

Fungi are routinely collected on a random quadrant basis within 50-miles of an SRS center-point and designated as "E" area samples, and outside of the 50-mile perimeter, but within the remainder of South Carolina as background samples in "B" area quadrants. The random samples allow probabilistic hypothesis testing or comparison of the radionuclide populations in the "E" versus "B" areas. The null hypothesis is that these two populations are the same for any specified radionuclide subjected to at least the nonparametric Wilcoxon Rank Sum and modified Quantile tests for locations. Samples are routinely analyzed for a gamma suite of radionuclides found in Section 3.2.5 fungi tables. The radionuclide abbreviations are defined in the list of acronyms. Additional nonrandom samples are sometimes taken to compare to other media nonrandom findings such as Cs-137 in deer. Extra nonrandom samples were collected within the 10-mile exclusion zone around commercial nuclear reactors within the South Carolina background area to confirm that the exclusion zone perimeter is large enough to prevent elevating the South Carolina background samples.

The 10-mile exclusion zone for background samples near nuclear reactors was confirmed as sufficient, since the nonrandom sample radionuclide averages within the exclusion zone were within the first standard deviation of the 2004-2007 South Carolina background average for all radionuclides detected in fungi (Section 3.2.5, Summary Statistics). Five gamma-emitting radioisotopes were detected in 2007 (beryllium-7, cesium-137, potassium-40, lead-212, and lead-214) within the 50-mile SRS perimeter study area.

A trend of increasing Cs-137 concentration was noted in the 2004-2007 data as the data was narrowed to the upper coastal-plain region samples. Also, the comparison of fungi and soil Cs-137 activity concentrations found in the same quadrants indicated a consistently higher average Cs-137 activity concentration in fungi compared to soil. These results indicated that Cs-137 may become bioconcentrated in fungi, and represent increased exposure for the wild mushroom consumer, whether deer or human. Research of the literature suggests the occurrence of a higher Cs-137 concentration in backgrounds may be dependent on the depth and content of the organic layer at the sampled locations, especially K-40 (Linkov and Schell 1999). Cesium-137 is the primary contributor to sportsman dose and a study during August, September, and no later than October, of bolete abundance related to weather, K-40, and Cs-137 concentrations in deer and boletes could prove fruitful. This would quantify the relative importance of bolete fungi and deer consumption to the sportsman and mushroom consumers dose.

RESULTS AND DISCUSSION

Results from vegetation and fungi analyses are included in Section 3.2.4; summary statistics are presented in Section 3.2.5. The following radionuclides were not detected above the minimum detectable activity in 2007: sodium-22 (Na-22), manganese-54 (Mn-54), cobalt-58 (Co-58), cobalt-60 (Co-60), zinc-65 (Zn-65), yttrium-88 (Y-88), zirconium-95 (Zr-95), ruthenium-103

(Ru-103), antimony-125 (Sb-125), iodine-131(I-131), cesium-134 (Cs-134), cerium-144 (Ce-144), europium-152 (Eu-152), europium-154 (Eu-154), europium-155 (Eu-155), radium-226 (Ra-226), actinium-228 (Ac-228), uranium/thorium-238 (U/Th-238), and americium-241 (Am-241).

Tritium in Vegetation

Tritium is a naturally occurring radioisotope, although in very low concentrations (USEPA 2007). Sources of man-made tritium include nuclear reactors and government weapons production plants. Tritium releases on the SRS include both atmospheric and liquid contributions (WSRC 2008a). Although the United States Environmental Protection Agency (USEPA) has not established a Maximum Contaminant Level (MCL) for tritium in solid media (e.g. vegetation), the MCL for drinking water has been set at 20,000 picocuries per liter (pCi/L) (USEPA 2008b).

Tritium was detected in vegetation from all 16 of the perimeter sites sampled in 2007. Six of the stations exhibited tritium levels greater than the Lower Limit of Detection (LLD) in all four sampling months. The highest tritium level in 2007, 1901 pCi/L, occurred in February on the west side of SRS at station BWL-008. Station BWL-009, also on the west side of SRS, produced the highest levels in May and August, 1318 pCi/L and 522 pCi/L, respectively. Station AKN-005, on the north side of SRS, exhibited the highest activity in November, 1076 pCi/L.

Tritium was detected at all three 25-mile radius stations, twice at each station. No randomly selected stations within 50 miles of SRS, nor any background stations, exhibited tritium activity above the LLD.

Three of the four highest quarterly tritium activities in 2007 were from sites on the western side of the SRS. This is similar to results from 2003 through 2006 sampling (Figure 1, Section 3.2.3; SCDHEC 2007d). Tritium releases from the nearby Vogtle Electric Generating Plant in Georgia may account for elevated tritium levels in this area of the SRS, or the influence of Fourmile Creek and Pen Branch, both of which have high levels of tritium. However, stations on the east and north sides of SRS also exhibited relatively high tritium activities in 2007. These results underscore the variability of tritium occurrence around SRS.

Tritium analysis results from ESOP and DOE-SR sampling are presented in Table 1,Section 3.2.3. However, differences between the two programs in sampling dates, the vegetation sampled, and analysis methods should be considered during comparison. Data comparison of associated locations from the two programs was conducted by converting from pCi/g to pCi/L, using a dry/wet weight ratio of 0.3 furnished by DOE-SR, using the formula:

$$pCi/L = pCi/ml \times 1000 = [pCi/g \times (1/0.3)] / (1 - 0.3).$$

Results from the two colocations were less than the detection limit for the DOE-SR program, while ESOP had detections of 666 pCi/L and 1,113 pCi/L at those locations. The DOE-SR program detected tritium from four perimeter stations in 2007; ESOP detected tritium in samples from eight comparable stations at similar times. Average tritium levels at the stations in Table 1

were compared, using only detections to calculate averages. The DOE-SR average, 447 (± 136) pCi/L, was within one standard deviation of the ESOP average, 774 (± 380) pCi/L.

The SAS™ NPAR1WAY Wilcoxon Rank Sum (WRS), Median, and modified Quantile two-sample tests were performed on the random sample results of relevant radionuclides (tritium and Cs-137) in 2007, and for 2004-2007. The null hypothesis assumption was that for the radionuclide tested, the SRS 50-mile perimeter sample population was the same as the South Carolina background population at the 5% or 1% significance level with respect to location. Tritium comparisons of multi-year vegetation samples would be inconclusive due to the decay for the time period specified and the short half-life of tritium. Null hypothesis statistical tests of future annual samples for tritium should not be rejected in favor of the alternate hypothesis unless the population concentrations change significantly. The assumption of uniform aerial deposition is also a weak point in the analysis. The tritium null hypothesis was not rejected at the 5% significance level for both the WRS and modified Quantile tests for the 2007-year tritium data. Also, a power calculation reference (NFEC 1999) involving the medians indicated that many more samples (approximately 340) were needed on an annual basis to support the alternate hypothesis at the present levels of activity. Tritium activities in the two populations were not significantly different.

Gamma in Vegetation

The naturally occurring isotope potassium-40 (K-40) was detected from all stations where gamma samples were collected in 2007. Beryllium-7 (Be-7) and the lead (Pb) isotopes Pb-212 and Pb-214 were also detected, but not from all locations. Because these are naturally occurring isotopes the results will not be discussed in this section, but are presented in Section 3.2.4.

Cesium-137 (Cs-137) is a man-made fission product, and was a constituent of air and water releases on SRS, mainly from F- and H-Areas. Liquid releases also occurred from the production reactors as a result of leaking fuel elements in the 1950s and 60s (WSRC 1999b).

Cesium-137 (Cs-137) was detected at eight of nine perimeter stations sampled in 2007, and seven of the eight stations produced Cs-137 results greater than the Minimum Detectable Activity (MDA) in all four months (Section 3.2.4). AKN-008 exhibited the highest Cs-137 activity in February, 0.458 pCi/g. BWL-006 exhibited the highest activity in May, 0.917 pCi/g. AKN-003 had the highest August activity, 1.073 pCi/g, and in November, 1.342 pCi/g, which was the highest activity in 2007.

Two randomly selected stations within 50 miles of SRS, in Allendale and Bamberg counties, exhibited Cs-137 activity above the MDA. No random background samples exhibited detectable Cs-137 activity.

Results of analysis for Cs-137 followed established trends in 2007 (Figure 2, Section 3.2.3; SCDHEC 2007d). Stations around the perimeter of SRS selected for sampling because of continued Cs-137 detections again produced detectable activity, with the exception of AKN-002. AKN-003 on the north side of the SRS near Jackson exhibited the highest average activity for

2007. A new station was added west of AKN-005 in 2005 to document CS-137 activity in this area near New Ellenton. This station, AKN-008, exhibited the third-highest average in 2007.

Gamma analysis results for Cs-137 from ESOP and DOE-SR sampling in 2007 are presented in Table 2, Section 3.2.3. The air station on Patterson Mill Road, a colocation between the two programs, exhibited similar results for both programs (0.141pCi/g, ESOP; 0.743 pCi/g, DOE-SR) as it had in most previous years. Another colocation at the Allendale Gate, reinstated by DOE-SR in 2004, produced dissimilar results (0.917 pCi/g, ESOP; <MDC, DOE-SR).

Differences in analysis and sampling methods (e.g., ESOP collects leaves from trees, whereas EMS collects grass) may account for this disparity. For the other DOE-SR stations, the closest ESOP stations were selected for comparison. For the most part, DOE-SR and ESOP data were similar, with the greatest difference being 0.603 pCi/g. These results include the DOE-SR East Talatha station and the ESOP stations AKN-008 at New Ellenton and AKN-005, which is approximately two miles east of New Ellenton. AKN-005 and AKN-008 have consistently exhibited Cs-137 activity, usually the highest activity of the sites around SRS, while the East Talatha location produced the second-highest DOE-SR result in 2007. Average Cs-137 levels at the stations in Table 2 were compared, using only detections to calculate averages. The DOE-SR average (0.409 ± 0.213 pCi/g) was within one standard deviation of the ESOP average (0.502 ± 0.375 pCi/g).

The same statistical tests were performed on the Cs-137 data as for tritium. These tests were performed on the random sample results from 2007 using the null hypothesis that for Cs-137 the SRS environmental population was the same as the South Carolina background population at the 5% significance level. This hypothesis was not rejected, indicating that Cs-137 levels in vegetation locations near the SRS were not significantly different than locations in the South Carolina background. The random Cs-137 data cannot be compared on a four-year basis since the 2004 data were analyzed dry and the 2005 and 2006 data were analyzed wet. The results of a three-year comparison under the same null hypothesis did not reject the null hypothesis at the 1% significance level. The 1% significance level results are questionable for greater than a three year comparison, since additional uncertainty is due to the decay difference between samples over a three-year period compared to the relatively short half-life of Cs-137. Therefore, only the last three years random samples will undergo null hypothesis testing for Cs-137 in the future. Cesium-137 activities in the two populations were not significantly different.

Gamma in Fungi

Five out of 24 radioisotopes surveyed were detected in mixed-fungi samples collected throughout South Carolina in 2007. Many of the radionuclides surveyed are naturally occurring radioactive materials (NORM) that have also been stored or produced as byproducts at DOE-SR. Detections above background are not necessarily due to DOE-SR production activities, since many could have other sources such as NORM in soil, past nuclear tests fallout, or commercial nuclear facility releases. The primary radionuclides of concern in this gamma survey (since DOE-SR stopped reactor operations) are generally long-lived radionuclide contaminants released in the past that have significant risk potential to airborne critical pathways (WSRC 1997). These

include Am-241, Cs-137, Cs-134, Co-60, Eu-154, Eu-155, and U/Th-238. Only those radionuclide concentrations within the DOE-SR 50-Mile perimeter that are greater than the South Carolina background warrant discussion. Fungi, whether edible or nonedible, are an excellent survey media to detect concentrations of radionuclides in terrestrial media for fungi are the primary bioconcentrator of Cs-137 (Botsch 1999). Cesium-137 is the primary radionuclide of concern due to the extremely high bioconcentrations detected in fungi by Botsch and the radionuclide contaminants found in mushroom consumers (man, deer, and other game). Precedence for the monitoring of fungi was established at the Savannah River Plant when mushroom samples were found to contain 2 to 540 pCi/g of Cs-137 in 1983, and 19 to 640 pCi/g in 1984 at locations within SRS (DuPont 1984). The abundance of mushrooms may be related to weather factors and could explain some Cs-137 concentration variations in deer and hogs. The Cs-137 contribution to food dose in humans was over one hundred times greater for fungi than the next largest food source (berries) at Chernobyl (Botsch 1999).

Radionuclides Found in Fungi in 2007

The five radioisotopes found in the SRS 50-Mile perimeter fungi were beryllium-7 (Be-7), potassium-40 (K-40), Cs-137, lead-212 (Pb-212), and Pb-214 (Section 3.2.4). The same five radioisotopes were found in fungi in the South Carolina background quadrants and in the nonrandom samples.

The random (22) and nonrandom sample (5) results were combined for summary statistics (average, standard deviation, and median). Note the difference between random, nonrandom, and composite background samples (all random plus nonrandom background samples) (Section 3.2.5). Subtraction of the 2007 South Carolina background quadrant average activity concentrations from the SRS 50-mile perimeter quadrant average left only Be-7, K-40, and Pb-214 above the 2007 South Carolina average background. Subtraction of the median background concentrations indicated that only Be-7 and Pb-212 were above background in 2007. The only radionuclide of concern was Cs-137. The others were all NORM.

Thirteen other nonrandom samples were collected within a 10-mile exclusion zone for background areas containing commercial nuclear reactors (Section 3.2.4). The purpose was to investigate whether the 10-mile exclusion zone appeared sufficient to prevent collecting elevated background samples outside of these exclusion zones. No new radionuclide detections occurred within these exclusion zones and the same radionuclides found in the background samples were detected. The average within the nuclear exclusion zone of the commonly found radionuclides was within one standard deviation of the background average for all radionuclides detected (Section 3.2.5).

A single nonrandom sample from the eastern part of the McBee area in 2007 exhibited Cs-137 (7.82 pCi/g) at five standard deviations higher than the 2004-2007 average activity in the South Carolina background, 0.99 (± 1.50) pCi/g. This seemed to be reflected in higher background Cs-137 detections in deer from the McBee area. This location is outside of the exclusion zone for the Robinson Nuclear Power Plant. However, a second sample in the western half of the McBee area was only 0.15 pCi/g for Cs-137, and a third sample in B18 south of the plant at the ten mile exclusion zone limit was only 0.27 pCi/g. Since all were mixed fungi gathered from

specific areas, the difference may be due to the ability of the individual species in the composite samples to bioconcentrate Cs-137 relative to media source concentrations (e.g., potassium). The soil media-type chemistry influences the uptake of any available cesium (e.g., coastal plain versus piedmont soils). The higher Cs-137 sample was taken from a richly organic area within a thick stand of Ti-ti (*Cyrilla racemiflora*). The other two samples were from more sandy than loam soil with little organic debris. Also, local deposition rates in different areas related to nuclear bomb tests in the sixties and seventies can contribute to sample differences.

Random radioisotope maximum concentrations in 2007 found in fungi included naturally occurring radioactive material (NORM); Be-7 (8.19 pCi/g), found in the Saluda South E42 piedmont quadrant; K-40 (20.77 pCi/g), found in the E43 Olar lower coastal plain quadrant; Pb-212 (0.45 pCi/g), found in the B39 Saluda North piedmont quadrant (Thorium-232 or Th-232 series NORM); Pb-214 (0.93 pCi/g), probable NORM found in the E42 Saluda South piedmont quadrant and a uranium-238 (U-238) series NORM or plutonium-238 (Pu-238) series product; and Cs-137 (7.82 pCi/g), found in the nonrandom sample within the eastern half of the McBee area Carolina Sandhills National Wildlife Refuge (Section 3.2.4). All other gamma scan radionuclides listed in the data tables were less than the minimum detectable activity.

Cesium-137 was detected at 12 of 22 random quadrant fungi locations in 2007, 21 of 25 in 2006, 16 of 24 in 2005, and 10 of 24 locations in 2004. Atomic bomb test fallout tracking charts and data in combination with additional sampling statistics may eventually produce enough evidence to conclude whether the SRS 50-Mile perimeter Cs-137 population has a pattern of maximums that correspond with atomic bomb test fallout tracks. However, the presence of commercial nuclear power reactors in the South Carolina background may render the analysis inconclusive for facilities displaying similar weather tracks. The 2007 nonrandom fungi Cs-137 background result (1.92 pCi/g) was within two standard deviations of the random Cs-137 background results (1.21 pCi/g average ± 0.62 pCi/g, Section 7.0). The highest 2007 Cs-137 average detection (7.82 pCi/g) occurred in a nonrandom background sample in the Carolina Sandhills National Wildlife Refuge, Middendorf quadrant (Section 3.2.5).

Radionuclides Found in Fungi 2004-2007

The 2004-2007 radionuclide detections above the South Carolina background add only Ac-228, Eu-155 (1 detection each), and Ra-226 to the 2007 detections (Section 3.2.5). Actinium-228 (2.34 pCi/g) is third in the thorium-232 series (NORM). Europium-155 (0.71 pCi/g) was found in the Foxtown Quadrant in a floodplain area below a boat ramp in 2004, and is a fission product important on a percentage-of-risk basis in the long term. This particular detection was suspect due to the presence of Ac-228 and Pb-212 contributions to a false positive. Radium-226 appears to be from NORM sources (U-238) upgradient of collection locations. Pb-214 (U-238 series) is NORM. Beryllium-7 (tritium process), and Pb-212 (natural thorium-232 decay) half-lives were too short to have come from DOE-SR reactor products since they are no longer in operation. Diffuse and fugitive releases were estimated from waste site inventories and were reduced in 2007 due to the completion of the General Separations Area Consolidated Unit (GSACU) by DOE-SR (WSRC 2008a).

Lead-212 is a thorium series decay product far down the series and related to NORM sources. The K-40 and Pb-214 detections were also related to NORM sources. Cesium-137 (half-life 30.2 yrs.) was detected at 18 locations in 2007, and reflects the importance of Cs-137 bioconcentration in fungi (Botsch 1999, Seel 1995). The highest South Carolina quadrant average for Cs-137 occurred in E31 in the 2004 (10.87 pCi/g average of three samples), Shaw Creek samples in the Oakwood quadrant in Aiken County (Section 3.2.5). Also, a comparison of the Cs-137 activity concentrations for the same random quadrant (E31) indicated a higher Cs-137 activity concentration for fungi (10.87 pCi/g) versus soil (0.11 pCi/g), and nonedible plants (<0.026 pCi/g). The South Carolina Cs-137 background averages (e.g., 0.47 pCi/g fungi v. 0.42 pCi/g soil project) indicated less bioconcentration and/or less deposition. The highest 2007 detection of Cs-137 (7.82 pCi/g) occurred in the McBee area, Carolina Sandhills National Wildlife Refuge, in mixed fungi and was more than the 1986 concentrations found in wild *Boletus* (3.75 pCi/g) and *Russula* (3.66 pCi/g) species by the Vermont State Environmental Radiation Surveillance Program (RADNET 2006). This difference may represent depositional track concentrations related to global fallout, local nuclear sources, or bioconcentration differences in fungi. The 2004-2007 Cs-137 average for all SRS perimeter fungi (1.46 pCi/g) was more than background (0.99 pCi/g) fungi (Section 3.2.5). The median in fungi over the same four year period (0.92 pCi/g was also higher than background (0.46 pCi/g). The SRS perimeter fungi Cs-137 average (1.46 pCi/g) was greater than the SCDHEC 2007 Surface Soil Project random background average (0.42 pCi/g), and greater than the nonrandom 2007 background soil average (0.23 pCi/g). This indicated a potential bioconcentration of Cs-137 of approximately four times in mixed-fungi relative to soil background concentrations.

Comparison of Cs-137 averages around SRS based on South Carolina geographical regions was a more specific indicator of possible SRS influence. The 2004-2007 Cs-137 concentration trend increased as the comparison becomes more specific on a regional basis (1.46 pCi/g within the total 50-mile SRS perimeter, and 1.56 pCi/g for the South Carolina Coastal Plain Region, and 1.66 pCi/g for the Upper Coastal Plain alone, which was most specific for the SRS area soil types (Section 3.2.5). It was not possible to determine if this was due to nuclear reactor operation, fallout from past atomic tests, or both, since the radioactive clouds from many of these tests did track over South Carolina.

Note the 2004-2007 data adds three more radionuclides detected within the 50-mile study area: Ra-226, Eu-155, and Ac-228. False positives can occur in some gamma scan radionuclides. For example, the only detection of Eu-155 occurred in quadrant E6 in 2004 was suspect due to the presence of Pb-212 and Ac-228(WSRC 2003b). Both the U-238 and Pu-238 decay series lead to the U-234 decay path and Ra-226. However, given the locations and the lack of an SRS-indicated release, even in the diffuse category, this was probable NORM. Actinium-228 is in the Th-232 decay series (NORM). The yearly average trend for the detected radionuclides was illustrated in Figure 3, Section 3.2.3.

The “B” samples were background and not likely of SRS origin, especially if not detected within 50-miles of SRS. Also, short-life reactor product radionuclides with 10 half-lives already elapsed since the last SRS reactor run are essentially not detectable, and any detections would not be of SRS origin. The Pb-214 and Ra-226 from the same sample are found in the U-238 decay series (NORM) and were probably brought to the surface via aquifer upwelling down

gradient of Piedmont granite saprolitic material and upgradient of the sample locations above the SRS. The E31 Oakwood Quadrant Cs-137 average detection (10.87 pCi/g) in October of 2004 occurred in the Shaw Creek area and ranged from 1.57 to 18.13 pCi/g of bioconcentration in collected mixed fungi that contained some boletes (Section 3.2.5). This highest result for Cs-137 (18.13 pCi/g in 2004) was more than twice the highest background to date (7.82 pCi/g in 2007). This may reflect the ability of the individual species collected to bioconcentrate Cs-137 and the lack of potassium within the fungi substrate (Botsch 1999). The K-40 concentration (17.70 pCi/g) within the highest Cs-137 sample (AKN-254, October 2004) was less than the highest K-40 result to date (29.31 pCi/g) in the B83 Hickory Tavern piedmont quadrant (collected 08/04) where the Cs-137 concentration was less than the MDA. This reflects the general trend of Cs-137 bioconcentration or uptake increasing with decreasing amounts of potassium in the soil (Seel 1999). The amount of Cs-137 contamination due to SRS production activities was unknown since other sources deposited Cs-137 in South Carolina. Historical fallout from nuclear bomb atmospheric testing and accidental releases in the 1950s and 1960s probably contributed some of the detected Cs-137 (a fission product of commercial reactors as well).

Cesium-137 in Fungi Comparisons

SAS™ (release 9.1) statistical tests of the South Carolina background and SRS 50-mile perimeter populations was applied to the 2005 through 2007 data for radionuclides of concern to test the null hypothesis that the two populations of specific radionuclides were from the same location (USEPA 2000a). Probabilistic testing (Wilcoxon Rank Sum, Median, and modified Quantile) was applied to only Cs-137 in random fungi population locations. The null hypothesis was not rejected in any of these tests at a significance level of five percent for the annual data or at one percent for the three-year random study data. Therefore, Cs-137 in the two population locations was not significantly different.

DOE-SR did not collect fungi in 2007, but the SCDHEC 2007 maximum Cs-137 detection (7.82 pCi/g) was far less than the 1983 (540 pCi/g) and 1984 (640 pCi/g) DOE-SR maximum Cs-137 detections in unidentified fungi (DuPont 1984). Also, the maximum mixed fungi detection was similar to 1986 detections found in Vermont fungi (RADNET 2006). The SCDHEC overall average (all random plus nonrandom) Cs-137 detection in mixed fungi for 2007 (0.82 pCi/g) was lower than the 2004-2007 averages (1.46 pCi/g) (Section 3.2.5). Notice that the averages increase steadily for the perimeter Cs-137 concentration in fungi as the compared areas change from All SC (1.46 pCi/g) to SC Coastal Plain (1.56 pCi/g) to SC Upper Coastal Plain (1.66 pCi/g). Also, notice the same trend occurs in the background average for these geological areas respectively (0.99, 1.27, and 2.18 pCi/g). However, the lower coastal plain reverses this trend dropping to 1.34 pCi/g in the perimeter and 1.08 pCi/g in the SC background (calculated, but not included in table). Atomic test fallout generally tracked from the northwest to the southeast or from the southwest to the northeast dependent on the time of year and weather patterns. This general weather trend would take fallout to the east in general, but why does it reverse trend in the lower coastal plain? Cesium-137 tends to be tied up by the organic layers in soil and this may merely reflect less of an organic layer in the sandy lower coastal plain where Cs-137 depositions may sink to a depth beyond any fungal mycelial zone. There are many publications that indicate long-term retention of Cs-137 in the organic layer, if present (Linkov and Schell 1999) and cesium is quickly integrated into the nutrient cycle (Rommelt 1990). Fungal fruit

bodies tend to concentrate Cs-137, Cs, and Rb (all Group IA elements), and lower Ca and Sr (all Group IIA elements) concentrations (Yoshida and Muramatus 1998). The removal of accumulated elements by fungi may be used as a phytoremediation process in the future (Entry et al. 1996).

The yearly trend for radionuclide detection averages in all fungi regardless of location is represented in Figure 3, Section 3.2.3. A single sample of mixed moss and fungi on waterlogged stumps in floodwaters of the South Edisto River in 2004 was the only sample from 2004 to 2007 to have detections of Eu-155 and Ac-228. Also, the higher Ra-226 detections occurred in that sample. A second submission of the remainder of the sample that included decomposing log debris did not confirm the Eu-155 and Ac-228 detections, but did confirm a high Ra-226 detection.

No additional detections changed previous years findings that the study area and South Carolina background populations radionuclide concentrations are the same (null hypothesis). However, all radionuclide concentration activities detected so far indicated additional random sampling must continue before the power level (sampling number) can support any alternative hypothesis.

The radionuclide detections in general were possibly due to floodplain locations that may bioconcentrate radionuclides and organic material from up-gradient sources and direct aerial deposition. Historical nuclear atmospheric testing in the 1950s and 1960s and commercial nuclear power plants have also produced fission by-products (e.g., Cs-137 and Eu-155). Any detection of these radioisotopes cannot be assumed to be from SRS alone. Four years of fungi sampling by SCDHEC in publicly accessible areas has not shown the comparable concentrations of Cs-137 that were found during on-site sampling by DOE-SR during the 1980s. Current concentrations of Cs-137 in fungi samples are detectable, but well below concentrations that would pose a public health threat from a radiological standpoint. Although it was not specifically stated, it could be assumed that the DOE-SR sampling conducted in the 1980s was conducted in areas of known contamination that are administratively controlled to prevent public access.

CONCLUSIONS AND RECOMMENDATIONS

ESOP conducted independent vegetation monitoring in 2007 at 17 locations around the perimeter of the SRS, three locations 25 miles from the center of SRS, 12 locations selected at random from within a 50-mile radius of SRS, and 12 background locations greater than 50 miles from SRS. Tritium was detected in vegetation from all of the perimeter and 25-mile stations, but none of the 50-mile or background stations. As in previous years, activity levels were higher in vegetation collected from the western side of SRS. ESOP data supports the DOE-SR conclusion that elevated tritium levels at the site perimeter are due to atmospheric releases from SRS, although Plant Vogtle, a commercial nuclear power plant across the Savannah River from SRS, may also have an effect. Tritium levels decrease with increasing distance from SRS facilities.

A comparison of ESOP and DOE-SR tritium data was performed. DOE-SR samples did not exhibit tritium activity at either colocation, while both ESOP samples did. DOE-SR detected tritium from four perimeter stations, while ESOP detected tritium at all perimeter locations.

There are differences in analysis and sampling methods between the programs (e.g., ESOP collects leaves from trees, whereas EMS conducts annual grass collections), but the abundance of tritium detections by ESOP in tree leaves versus DOE-SR grass needs further investigation. It appears that sampling of broadleaf vegetation may be a better indicator of radionuclide occurrence around the SRS perimeter. DOE-SR data are reported in pCi/g without denoting whether this activity relates to a gram of water or a gram of wet vegetation. ESOP recommends that DOE-SR report tritium activity in a more relevant manner, such as pCi/ml as in previous reports, to reflect the tritium activity in the water extracted from the sample.

Samples from eight of nine SRS perimeter stations exhibited Cs-137 activity at levels similar to 1998-2006, although there appears to be a downward trend in activity levels. It is unclear why these sites have higher cesium levels, as they are not located near SRS facilities, nor in areas known to be affected by past releases. A review of the deposition plume from the 1955 Teapot Hornet test (Till et al. 2001) showed the highest radiation levels were not associated with the areas where ESOP finds the highest Cs-137 levels in vegetation. ESOP and DOE-SR results from the colocation on Patterson Mill Road exhibited similar Cs-137 activity levels, while results from another colocation at the Allendale Gate were quite different, with DOE-SR not detecting any activity while the ESOP sample exhibited the highest level for that month.

A quarterly sampling schedule will be continued in 2008. Sampling will again be conducted at randomly selected sites around South Carolina to determine background and near-SRS levels for tritium and gamma-emitting radionuclides.

Some fungal radionuclides detected in a single sample in previous years were not detected in 2007 (Eu-155, Ra-226, Ac-228). The single detection of Eu-155 was considered a false positive due to the presence of Pb-212 and Ac-228 in the same sample. However, the high background sample for Cs-137 (7.82 pCi/g, March 2007) in fungi in the eastern part of the Carolina Sandhills National Wildlife Refuge corresponded with a Cs-137 (7.02 pCi/g) maximum in deer from that area in the winter of 2006. This corresponded with a wetter summer and possibly an increased availability of fungi for deer consumption. Contrast this with the drought summer of 2007 and possibly fewer fungi available for deer and the reduced Cs-137 background maximum (2.09 pCi/g) in deer in the winter of 2007. Also, one sample just downstream and very close to the Robinson Nuclear Power plant was less than the MDA for Cs-137. Additionally, 13 nonrandom samples collected inside the 10-mile nuclear exclusion zones for background samples near all commercial reactors yielded only one Cs-137 detection of 1.12 pCi/g (Crackerneck area northwest of SRS and north of Plant Vogtle). Compare this to the 2004-2007 background quadrant average outside of the nuclear exclusion zones for Cs-137, 0.99 (± 1.50) pCi/g. The background nonrandom exclusion zone sample average was within the first standard deviation of the 2004-2007 South Carolina background averages for all radionuclides detected in fungi. Also, no new radionuclide detections occurred within these exclusion zones.

This fungi maximum may merely reflect the local soil types and fungi substrates surveyed in a given year. The significance of any trending should be revealed by future statistical studies of several years of accumulated data. The radioisotope background contributions found in fungi from 2004 to 2007 may have originated from past atomic tests or commercial nuclear power companies, and cannot be distinguished from the DOE-SR contributions within a 50-mile

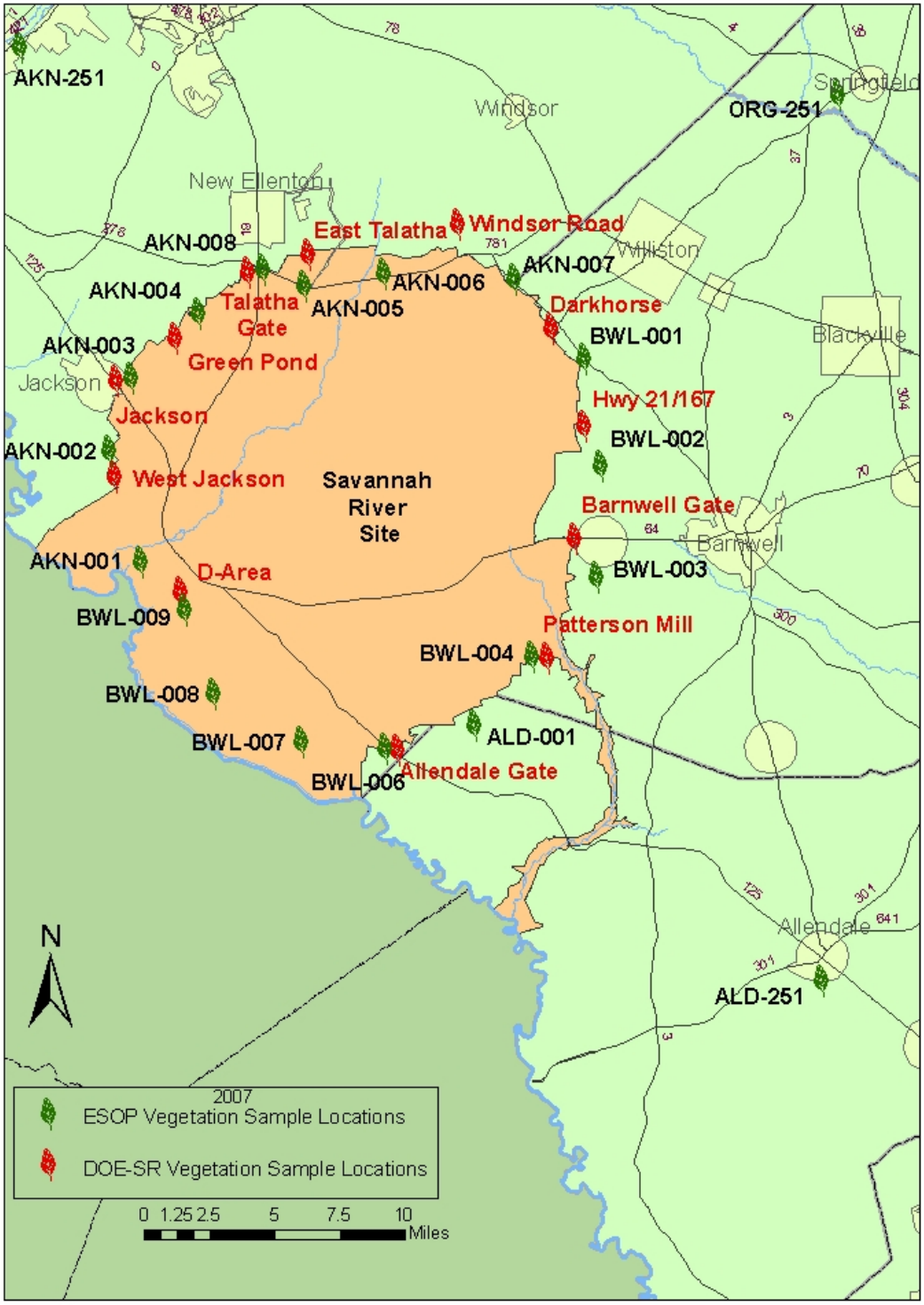
perimeter of a center-point within the SRS that excludes a 10-mile radius from reactors. However, the 2004 to 2007 Cs-137 concentration trend within the 50-mile SRS perimeter in mixed fungi indicated increasing concentrations as the comparison was narrowed to the upper coastal plain regions. Also, the comparison of fungi and soil Cs-137 activity concentrations found in the same quadrants indicated a consistently higher average Cs-137 activity concentration in fungi compared to soil. These results indicated that Cs-137 may become bioconcentrated in fungi, and represent increased exposure for the wild mushroom consumer, whether deer or human. Elevated levels of Cs-137 in mushroom consumers after Chernobyl indicated that most of the bioconcentration seemed to occur primarily in bolete fungi (Botsch 1999). Wetter summers and other factors such as controlled burns may determine bolete fruit abundance and the subsequent increase of Cs-137 in mushroom consumers, whether deer or human. Research of the literature suggests the occurrence of a higher Cs-137 concentration in backgrounds may be dependent on the depth and content of the organic layer at the sampled locations. SCDHEC will continue to collect fungi, preferably boletes when available, to monitor the bioaccumulation of Cs-137 in fungi.

Back to Table of Contents

3.2.2

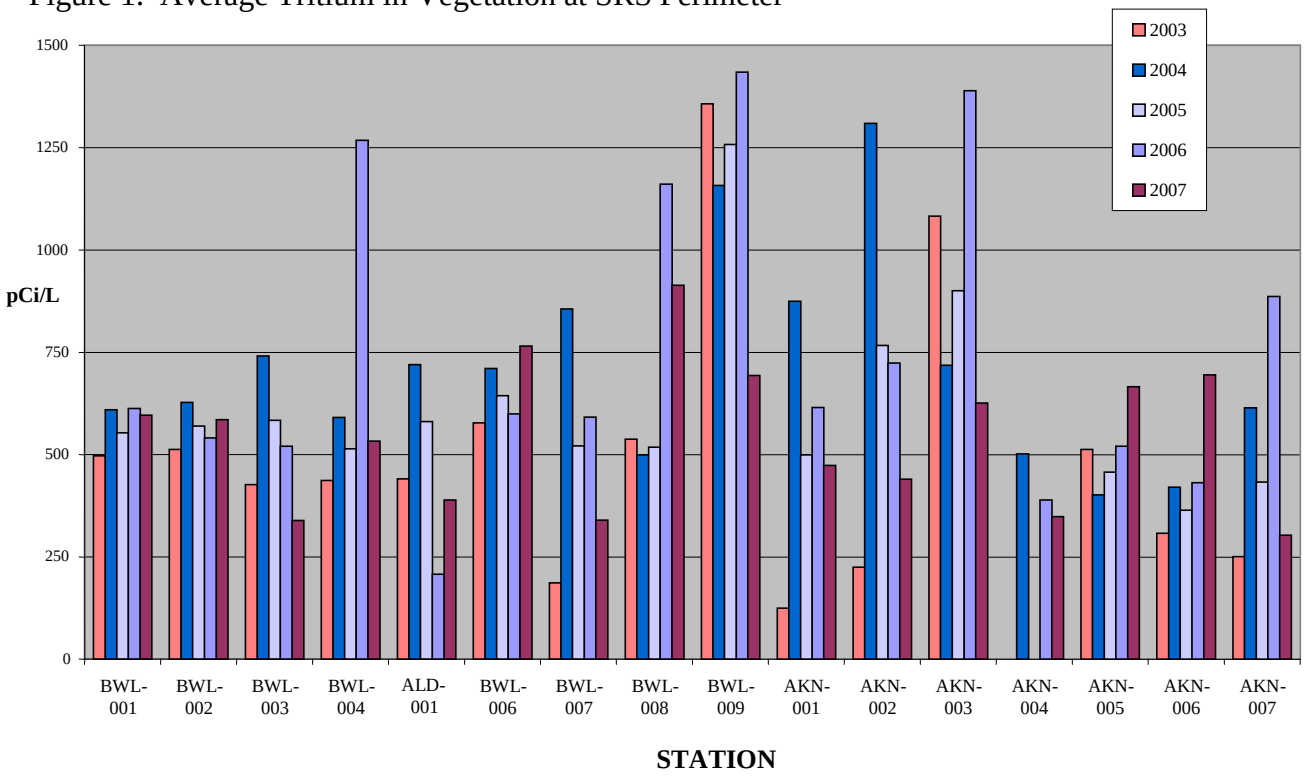
Back to Maps

Map 9. ESOP and DOE-SR Radiological Vegetation Sampling Locations, 2007



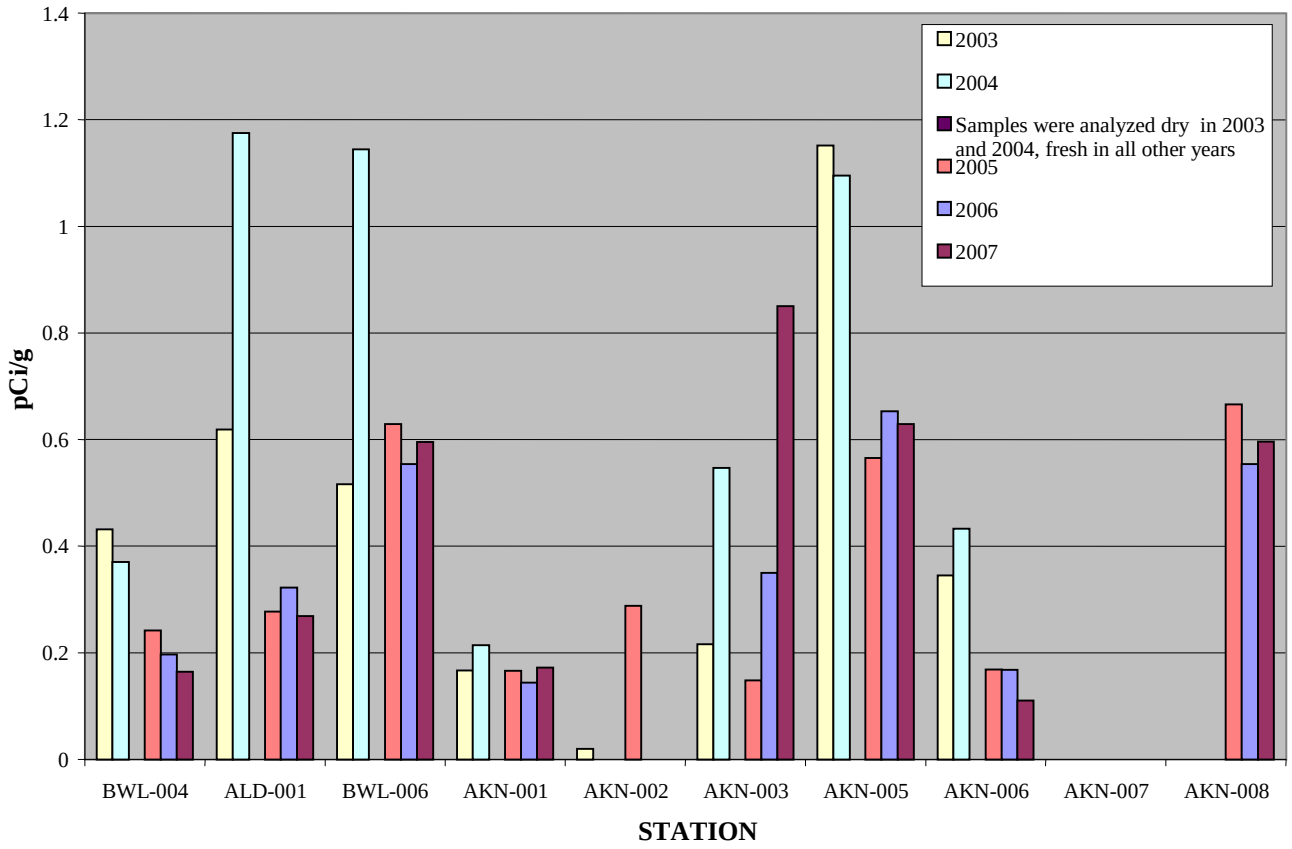
3.2.3 Tables and Figures
Radiological Monitoring of Terrestrial Vegetation

Figure 1. Average Tritium in Vegetation at SRS Perimeter



Tables and Figures
Radiological Monitoring of Terrestrial Vegetation

Figure 2. Average Cs-137 in Vegetation at SRS Perimeter Stations, 2003 - 2007



Notes:
AKN-007 sampled only in 2003 and 2004
AKN-008 added in 2005

Tables and Figures
Radiological Monitoring of Terrestrial Vegetation

Table 1. Comparison of Tritium Analyses, DOE-SR and ESOP Data, 2007

DOE-SR DATA (WSRC 2008)		Tritium		ESOP DATA		Tritium
Station	**Date**	**pCi/g**	**pCi /L[a]**	**Station**	**Date**	**pCi/L**
D-Area	6/20/2007	<MDC		BWL-009 [b]	5/25/2007	1318
West Jackson	6/20/2007	<MDC		AKN-002	5/18/2008	589
Jackson	6/20/2007	<MDC		AKN-003 [b]	5/18/2007	513
Green Pond	6/20/2007	<MDC		AKN-004 [b]	5/2/2007	538
Talatha Gate	6/18/2007	0.112	533	AKN-005 [b]	5/18/2007	457
East Talatha	6/18/2007	<MDC		AKN-006 [b]	5/18/2007	1154
Windsor Road	6/18/2007	0.0646	308	AKN-007	5/2/2007	<LLD
Darkhorse	6/18/2007	0.0749	357	BWL-001 [b]	5/2/2007	1127
Highway 21/167	6/18/2007	0.124	590	BWL-002 [b]	5/2/2007	1032
Barnwell Gate	6/18/2007	<MDC				
				BWL-003	5/2/2007	212
Patterson Mill Road [c]	6/20/2007	<MDC		BWL-004 [c]	5/18/2007	666
				ALD-001	5/18/2007	389
Allendale Gate [c]	6/20/2007	<MDC		BWL-006 [c]	5/18/2007	1113
		Average	447		**Average**	774
		Std Dev	136		**Std Dev**	380
		Median	445		**Median**	666

Notes:
<MDC denotes less than the Minimum Detectable Concentration (MDC not reported)
<LLD- denotes less than reported Lower Limit of Detection
[a] Converted [b] Comparable ESOP location [c] Colocation
Std Dev – Standard Deviation

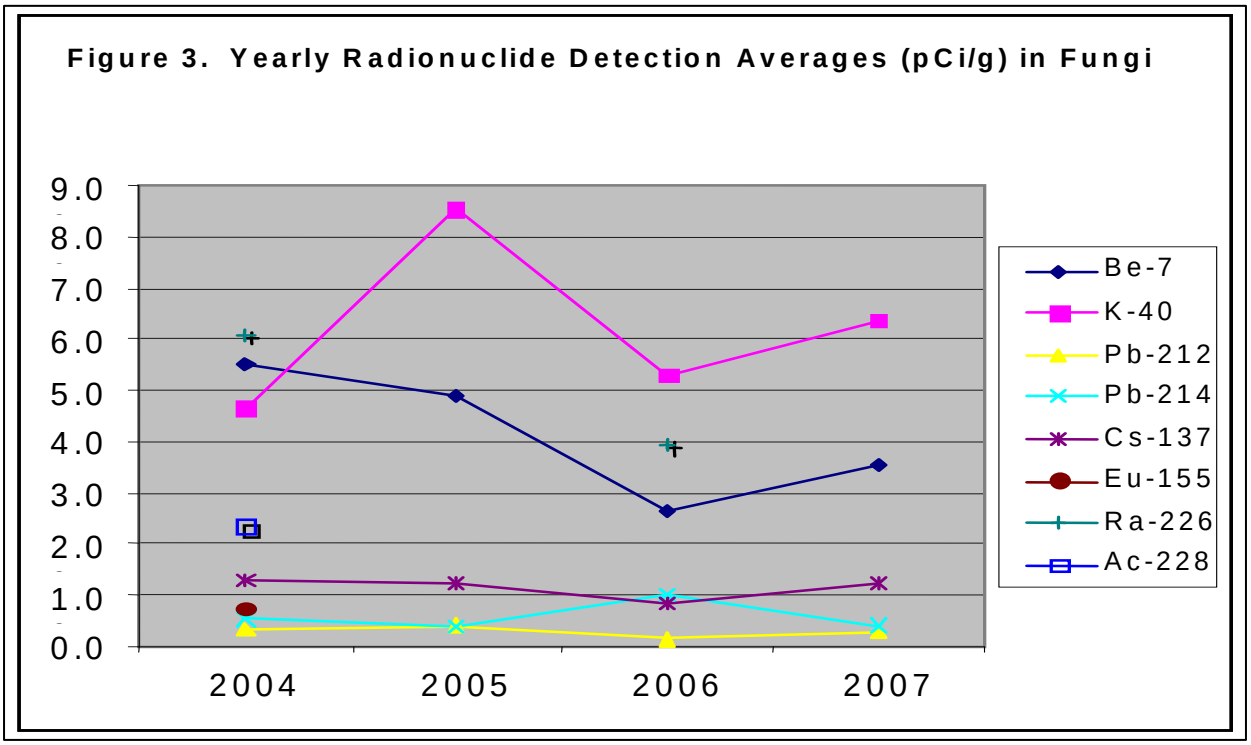
Tables and Figures
Radiological Monitoring of Terrestrial Vegetation

Table 2. Comparison of Gamma Analyses, DOE-SR and ESOP Data, 2007

DOE-SR DATA (WSRC 2008)		Tritium			ESOP DATA		Tritium	
Station	**Date**	**pCi/g**	**+/- 1 sig**	**pCi /L[a]**	**Station**	**Date**	**pCi/L**	**+/- 2 sig**
D-Area	6/20/2007	<MDC			BWL-009 [b]	5/25/2007	1318	131
West Jackson	6/20/2007	<MDC			AKN-002	5/18/2008	589	107
Jackson	6/20/2007	<MDC			AKN-003 [b]	5/18/2007	513	105
Green Pond	6/20/2007	<MDC			AKN-004 [b]	5/2/2007	538	107
Talatha Gate	6/18/2007	0.112	0.025	533	AKN-005 [b]	5/18/2007	457	105
East Talatha	6/18/2007	<MDC			AKN-006 [b]	5/18/2007	1154	128
Windsor Road	6/18/2007	0.0646	0.022	308	AKN-007	5/2/2007	<LLD	
Darkhorse	6/18/2007	0.0749	0.023	357	BWL-001 [b]	5/2/2007	1127	127
Highway 21/167	6/18/2007	0.124	0.019	590	BWL-002 [b]	5/2/2007	1032	124
Barnwell Gate	6/18/2007	<MDC						
					BWL-003	5/2/2007	212	95
Patterson Mill Road [c]	6/20/2007	<MDC			BWL-004 [c]	5/18/2007	666	112
					ALD-001	5/18/2007	389	101
Allendale Gate [c]	6/20/2007	<MDC			BWL-006 [c]	5/18/2007	1113	127
		Average	447			**Average**	759	
		Std Dev	136			**Std Dev**	367	
		Median	445			**Median**	628	

Notes:
<MDC denotes less than the Minimum Detectable Concentration (MDC not reported)
<MDA denotes less than the Minimum Detectable Activity
[a] Closest ESOP station with gamma collections [b] Colocation
Std Dev – Standard Deviation

Tables and Figures
Radiological Monitoring of Terrestrial Vegetation



Notes:
All of the radionuclide detections in fungi are naturally occurring radioactive materials except for cesium-137 (Cs-137) and europium-155 (Eu-155), which are fission products and possibly of DOE-SR origin. Eu-155 may be a false positive due to presence of actinium-228 and lead-212 in the sample.

Back to Tables and Figures

3.2.4 Data

Terrestrial Vegetation Radiological Monitoring Data

Vegetation Analysis Results.....267

Fungi Analysis Results.....290

Notes:

1. pCi/L - picocuries per liter
2. pCi/g - picocuries per gram
3. ND denotes non-detect
4. N/A denotes not applicable
5. Std Dev – standard deviation
6. LLD - Lower Limit of Detection
7. MDA - Minimum Detectable Activity
8. >8hle – Indicates no determination due to greater than 8 half-lives elapsed
9. See List of Acronyms for radionuclide definitions

Back to List of Data Tables

Terrestrial Vegetation Radiological Monitoring
Vegetation Analysis Results

Station:	AKN-001 - TNX Area				
Sample Date:		02/16/07	05/18/07	08/14/07	11/14/07
Radionuclides	Tritium (pCi/L)	599	497	326	<LLD
	+/- 2 sigma	106	105	95	N/A
	LLD	192	199	192	187
	Be-7 (pCi/g)	1.538	<MDA	<MDA	1.788
	+/- 2 sigma	0.319	N/A	N/A	0.438
	MDA	0.227	0.304	0.976	0.386
	K-40 (pCi/g)	1.788	3.149	1.648	2.377
	+/- 2 sigma	0.339	0.347	0.311	0.326
	MDA	0.123	0.135	0.162	0.159
	Co-60	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.024	0.016	0.019	0.022
	Cs-137 (pCi/g)	<MDA	0.107	0.184	0.227
	+/- 2 sigma	N/A	0.024	0.026	0.030
	MDA	0.027	0.016	0.017	0.019
	Pb-212	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.018	0.034	0.206	0.041
	Pb-214	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.041	0.378	0.042	0.048
	Am-241	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.033	0.136	0.132	0.147

Terrestrial Vegetation Radiological Monitoring
Vegetation Analysis Results

Station:	AKN-002 - Crackerneck gate				
Sample Date:		02/16/07	05/18/07	08/14/07	11/14/07
Radionuclides	Tritium (pCi/L)	623	589	221	325
	+/- 2 sigma	107	107	90	93
	LLD	192	199	192	187
	Be-7 (pCi/g)	4.135	0.974	<MDA	1.025
	+/- 2 sigma	0.494	0.249	N/A	0.437
	MDA	0.215	0.289	0.929	0.363
	K-40 (pCi/g)	2.150	3.444	2.152	2.074
	+/- 2 sigma	0.350	0.358	0.325	0.319
	MDA	0.169	0.122	0.148	0.154
	Co-60	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.019	0.015	0.019	0.020
	Cs-137 (pCi/g)	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.024	0.016	0.019	0.019
	Pb-212	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.021	0.035	0.040	0.039
	Pb-214	<MDA	0.083	<MDA	0.093
	+/- 2 sigma	N/A	0.028	N/A	0.031
	MDA	0.039	0.031	0.047	0.035
	Am-241	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.035	0.126	0.137	0.140

Terrestrial Vegetation Radiological Monitoring
Vegetation Analysis Results

Station:	AKN-003 - SRS Rd. 1				
Sample Date:		02/16/07	05/18/07	08/14/07	11/14/07
Radionuclides	Tritium (pCi/L)	739	513	<LLD	<LLD
	+/- 2 sigma	111	105	N/A	N/A
	LLD	192	199	192	187
	Be-7 (pCi/g)	2.095	1.022	<MDA	1.256
	+/- 2 sigma	0.374	0.349	N/A	0.489
	MDA	0.227	0.335	1.038	0.471
	K-40 (pCi/g)	1.508	2.535	1.485	2.488
	+/- 2 sigma	0.280	0.349	0.268	0.322
	MDA	0.159	0.118	0.141	0.125
	Co-60	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.023	0.015	0.016	0.022
	Cs-137 (pCi/g)	0.212	0.774	1.073	1.342
	+/- 2 sigma	0.035	0.073	0.095	0.118
	MDA	0.024	0.016	0.016	0.019
	Pb-212	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.019	0.036	0.036	0.041
	Pb-214	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.039	0.036	0.040	0.051
	Am-241	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.031	0.135	0.131	0.157

Station:	AKN-004 - SRS Rd. 1				
Sample Date:		02/07/07	05/02/07	08/14/07	11/06/07
Radionuclides	Tritium (pCi/L)	340	538	325	191
	+/- 2 sigma	99	107	95	85
	LLD	197	204	192	183

Terrestrial Vegetation Radiological Monitoring
Vegetation Analysis Results

Station:	AKN-005 - U.S. Hwy. 278				
Sample Date:		02/23/07	05/18/07	08/21/07	11/14/07
Radionuclides	Tritium (pCi/L)	465	457	<LLD	1076
	+/- 2 sigma	101	105	N/A	160
	LLD	192	204	209	183
	Be-7 (pCi/g)	1.780	0.733	<MDA	1.367
	+/- 2 sigma	0.394	0.341	N/A	0.335
	MDA	0.263	0.350	1.078	0.368
	K-40 (pCi/g)	1.835	3.013	2.310	1.673
	+/- 2 sigma	0.396	0.329	0.314	0.292
	MDA	0.170	0.107	0.137	0.147
	Co-60	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.025	0.016	0.020	0.017
	Cs-137 (pCi/g)	0.449	0.836	0.675	0.557
	+/- 2 sigma	0.061	0.079	0.068	0.056
	MDA	0.024	0.017	0.020	0.017
	Pb-212	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.020	0.038	0.039	0.036
	Pb-214	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.048	0.041	0.045	0.041
	Am-241	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.035	0.150	0.153	0.132

Terrestrial Vegetation Radiological Monitoring
Vegetation Analysis Results

Station:	AKN-006 - U.S. Hwy. 278				
Sample Date:		02/23/07	05/18/07	08/21/07	11/14/07
Radionuclides	Tritium (pCi/L)	639	1154	<LLD	291
	+/- 2 sigma	107	128	N/A	90
	LLD	192	204	209	183
	Be-7 (pCi/g)	2.541	0.912	<MDA	1.217
	+/- 2 sigma	0.348	0.316	N/A	0.345
	MDA	0.189	0.266	0.857	0.289
	K-40 (pCi/g)	1.601	2.463	2.258	1.814
	+/- 2 sigma	0.299	0.332	0.320	0.260
	MDA	0.133	0.136	0.154	0.117
	Co-60	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.020	0.014	0.019	0.015
	Cs-137 (pCi/g)	0.050	0.149	0.123	0.121
	+/- 2 sigma	0.025	0.025	0.023	0.020
	MDA	0.019	0.015	0.018	0.014
	Pb-212	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.019	0.032	0.037	0.031
	Pb-214	0.068	<MDA	<MDA	0.058
	+/- 2 sigma	0.031	N/A	N/A	0.023
	MDA	0.034	0.036	0.042	0.030
	Am-241	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.028	0.127	0.138	0.116

Terrestrial Vegetation Radiological Monitoring
Vegetation Analysis Results

Station:	AKN-008 - U.S. Hwy. 278				
Sample Date:		02/23/07	05/18/07	08/21/07	11/14/07
Radionuclides	Be-7 (pCi/g)	2.757	<MDA	<MDA	1.256
	+/- 2 sigma	0.424	N/A	N/A	0.402
	MDA	0.242	0.482	0.967	0.377
	K-40 (pCi/g)	1.903	3.294	2.160	2.143
	+/- 2 sigma	0.406	0.405	0.348	0.304
	MDA	0.190	0.173	0.169	0.135
	Co-60	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.197	0.190	0.019	0.018
	Cs-137 (pCi/g)	0.458	0.872	0.398	0.656
	+/- 2 sigma	0.061	0.083	0.044	0.063
	MDA	0.019	0.020	0.018	0.018
	Pb-212	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.021	0.458	0.039	0.038
	Pb-214	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.047	0.481	0.042	0.043
	Am-241	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.034	0.171	0.143	0.137

Terrestrial Vegetation Radiological Monitoring
Vegetation Analysis Results

Station:	AKN-007 - Aiken Co. Rd. 74				
Sample Date:		02/15/07	05/02/07	08/13/07	11/06/07
Radionuclides	Tritium (pCi/L)	<LLD	<LLD	232	374
	+/- 2 sigma	N/A	N/A	91	93
	LLD	197	204	192	183

Station:	BWL-001 - U.S. Hwy. 278				
Sample Date:		02/07/07	05/02/07	08/13/07	11/06/07
Radionuclides	Tritium (pCi/L)	465	1127	195	<LLD
	+/- 2 sigma	102	127	89	N/A
	LLD	197	204	192	<183

Station:	BWL-002 - Barnwell Co. Rd. 21				
Sample Date:		02/07/07	05/02/07	08/13/07	11/06/07
Radionuclides	Tritium (pCi/L)	803	1032	259	249
	+/- 2 sigma	141	124	92	88
	LLD	197	204	192	183

Station:	BWL-003 - Barnwell Co. Rd. 54				
Sample Date:		02/23/07	05/02/07	08/21/07	11/23/07
Radionuclides	Tritium (pCi/L)	365	212	<LLD	440
	+/- 2 sigma	97	95	N/A	98
	LLD	192	204	209	187

Terrestrial Vegetation Radiological Monitoring
Vegetation Analysis Results

Station:	BWL-004 - Air Station 614-62G				
Sample Date:		02/16/07	05/18/07	08/21/07	11/14/07
Radionuclides	Tritium (pCi/L)	400	666	<LLD	<LLD
	+/- 2 sigma	99	112	N/A	N/A
	LLD	192	204	209	<183
	Be-7 (pCi/g)	4.396	0.744	<MDA	<MDA
	+/- 2 sigma	0.563	0.354	N/A	N/A
	MDA	0.231	0.346	1.178	0.402
	K-40 (pCi/g)	1.786	2.729	2.351	2.474
	+/- 2 sigma	0.363	0.336	0.359	0.334
	MDA	0.234	0.121	0.169	0.143
	Co-60	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.021	0.016	0.020	0.020
	Cs-137 (pCi/g)	0.167	0.141	0.141	0.208
	+/- 2 sigma	0.032	0.027	0.027	0.030
	MDA	0.022	0.016	0.018	0.019
	Pb-212	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.020	0.036	0.040	0.040
	Pb-214	<MDA	0.066	<MDA	<MDA
	+/- 2 sigma	N/A	0.032	N/A	N/A
	MDA	0.045	0.036	0.048	0.049
	Am-241	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.036	0.145	0.150	0.151

Terrestrial Vegetation Radiological Monitoring
Vegetation Analysis Results

Station:	ALD-001 - Allendale Co. Rd. 12				
Sample Date:		02/16/07	05/18/07	08/21/07	11/14/07
Radionuclides	Tritium (pCi/L)	<LLD	389	<LLD	<LLD
	+/- 2 sigma	N/A	101	N/A	N/A
	LLD	192	204	209	<183
	Be-7 (pCi/g)	1.279	<MDA	2.788	0.999
	+/- 2 sigma	0.352	N/A	1.123	0.317
	MDA	0.219	0.354	1.031	0.323
	K-40 (pCi/g)	2.348	3.809	2.172	2.457
	+/- 2 sigma	0.433	0.378	0.335	0.324
	MDA	0.205	0.059	0.170	0.148
	Co-60	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.025	0.017	0.019	0.020
	Cs-137 (pCi/g)	0.089	0.218	0.574	0.195
	+/- 2 sigma	0.029	0.028	0.057	0.028
	MDA	0.022	0.016	0.019	0.017
	Pb-212	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.021	0.036	0.039	0.035
	Pb-214	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.047	0.040	0.044	0.041
	Am-241	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.033	0.144	0.149	0.130

Terrestrial Vegetation Radiological Monitoring
Vegetation Analysis Results

Station:	BWL-006 - Allendale Gate				
Sample Date:		02/16/07	05/18/07	08/21/07	11/14/07
Radionuclides	Tritium (pCi/L)	417	1113	<LLD	<LLD
	+/- 2 sigma	99	127	N/A	N/A
	LLD	192	204	209	<183
	Be-7 (pCi/g)	1.144	<MDA	<MDA	0.840
	+/- 2 sigma	0.345	N/A	N/A	0.267
	MDA	0.235	0.328	1.039	0.317
	K-40 (pCi/g)	1.706	2.452	1.904	1.516
	+/- 2 sigma	0.332	0.284	0.328	0.243
	MDA	0.183	0.095	0.158	0.119
	Co-60	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.020	0.013	0.020	0.018
	Cs-137 (pCi/g)	0.378	0.917	0.740	0.347
	+/- 2 sigma	0.050	0.084	0.070	0.036
	MDA	0.020	0.014	0.018	0.014
	Pb-212	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.019	0.032	0.038	0.031
	Pb-214	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.041	0.035	0.045	0.033
	Am-241	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma	N/A	N/A	N/A	N/A
	MDA	0.033	0.124	0.134	0.130

Terrestrial Vegetation Radiological Monitoring
Vegetation Analysis Results

Station:	BWL-007 - SRS Rd. A-17				
Sample Date:		02/23/07	05/25/07	08/17/07	11/23/07
Radionuclides	Tritium (pCi/L)	343	467	354	197
	+/- 2 sigma	96	103	96	87
	LLD	192	199	192	187

Station:	BWL-008 - SRS Rd. A-13				
Sample Date:		02/23/07	05/25/07	08/17/07	11/23/07
Radionuclides	Tritium (pCi/L)	1901	921	320	513
	+/- 2 sigma	154	119	95	100
	LLD	192	199	192	187

Station:	BWL-009 - D-Area				
Sample Date:		02/23/07	05/25/07	08/14/07	11/23/07
Radionuclides	Tritium (pCi/L)	581	1318	522	352
	+/- 2 sigma	103	131	107	94
	LLD	192	199	192	187

Station:	AKN-251 - Langley, SC				
Sample Date:		02/07/07	05/02/07	08/13/07	11/06/07
Radionuclides	Tritium (pCi/L)	278	362	<LLD	<LLD
	+/- 2 sigma	97	101	N/A	N/A
	LLD	197	204	192	<183

Station:	ALD-251 - Allendale, SC				
Sample Date:		02/07/07	05/02/07	08/17/07	11/06/07
Radionuclides	Tritium (pCi/L)	<LLD	371	<LLD	236
	+/- 2 sigma	N/A	100	N/A	87
	LLD	197	204	192	183

Station:	ORG-251 - Springfield, SC				
Sample Date:		02/07/07	05/02/07	08/13/07	11/06/07
Radionuclides	Tritium (pCi/L)	<LLD	224	303	<LLD
	+/- 2 sigma	N/A	95	94	N/A
	LLD	197	204	192	<183

Terrestrial Vegetation Radiological Monitoring
Vegetation Analysis Results

Station:	E39 - Allendale Co., SC	
Sample Date:		02/08/07
Radionuclides	Tritium (pCi/L)	<LLD
	+/- 2 sigma	N/A
	LLD	197
	Be-7 (pCi/g)	1.357
	+/- 2 sigma	0.310
	MDA	0.233
	K-40 (pCi/g)	1.360
	+/- 2 sigma	0.336
	MDA	0.171
	Co-60	<MDA
	+/- 2 sigma	N/A
	MDA	0.022
	Cs-137 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.021
	Pb-212	<MDA
	+/- 2 sigma	N/A
	MDA	0.017
	Pb-214	<MDA
	+/- 2 sigma	N/A
	MDA	0.037
	Am-241	<MDA
	+/- 2 sigma	N/A
	MDA	0.030

Station:	E44 - Allendale Co., SC	
Sample Date:		02/16/07
Radionuclides	Tritium (pCi/L)	<LLD
	+/- 2 sigma	N/A
	LLD	197
	Be-7 (pCi/g)	1.279
	+/- 2 sigma	0.352
	MDA	0.219
	K-40 (pCi/g)	2.348
	+/- 2 sigma	0.433
	MDA	0.205
	Co-60	<MDA
	+/- 2 sigma	N/A
	MDA	0.025
	Cs-137 (pCi/g)	0.089
	+/- 2 sigma	0.029
	MDA	0.022
	Pb-212	<MDA
	+/- 2 sigma	N/A
	MDA	0.021
	Pb-214	<MDA
	+/- 2 sigma	N/A
	MDA	0.047
	Am-241	<MDA
	+/- 2 sigma	N/A
	MDA	0.033

Terrestrial Vegetation Radiological Monitoring
Vegetation Analysis Results

Station:	E49 - Allendale Co., SC	
Sample Date:		02/08/07
Radionuclides	Tritium (pCi/L)	<LLD
	+/- 2 sigma	N/A
	LLD	197
	Be-7 (pCi/g)	1.468
	+/- 2 sigma	0.307
	MDA	0.202
	K-40 (pCi/g)	1.611
	+/- 2 sigma	0.274
	MDA	0.158
	Co-60	<MDA
	+/- 2 sigma	N/A
	MDA	0.019
	Cs-137 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.016
	Pb-212	<MDA
	+/- 2 sigma	N/A
	MDA	0.017
	Pb-214	<MDA
	+/- 2 sigma	N/A
	MDA	0.039
	Am-241	<MDA
	+/- 2 sigma	N/A
	MDA	0.028

Station:	B42 - Dorchester Co., SC	
Sample Date:		02/08/07
Radionuclides	Tritium (pCi/L)	<LLD
	+/- 2 sigma	N/A
	LLD	197
	Be-7 (pCi/g)	2.415
	+/- 2 sigma	0.376
	MDA	0.216
	K-40 (pCi/g)	1.657
	+/- 2 sigma	0.367
	MDA	0.185
	Co-60	<MDA
	+/- 2 sigma	N/A
	MDA	0.023
	Cs-137 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.020
	Pb-212	0.029
	+/- 2 sigma	0.013
	MDA	0.016
	Pb-214	0.067
	+/- 2 sigma	0.028
	MDA	0.039
	Am-241	<MDA
	+/- 2 sigma	N/A
	MDA	0.031

Terrestrial Vegetation Radiological Monitoring
Vegetation Analysis Results

Station:	B44 - Orangeburg Co., SC	
Sample Date:		02/15/07
Radionuclides	Tritium (pCi/L)	<LLD
	+/- 2 sigma	N/A
	LLD	197
	Be-7 (pCi/g)	1.787
	+/- 2 sigma	0.356
	MDA	0.236
	K-40 (pCi/g)	2.099
	+/- 2 sigma	0.380
	MDA	0.188
	Co-60	<MDA
	+/- 2 sigma	N/A
	MDA	0.019
	Cs-137 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.023
	Pb-212	<MDA
	+/- 2 sigma	N/A
	MDA	0.023
	Pb-214	0.116
	+/- 2 sigma	0.038
	MDA	0.040
	Am-241	<MDA
	+/- 2 sigma	N/A
	MDA	0.033

Station:	B48 - Berkeley Co., SC	
Sample Date:		02/15/07
Radionuclides	Tritium (pCi/L)	<LLD
	+/- 2 sigma	N/A
	LLD	197
	Be-7 (pCi/g)	0.797
	+/- 2 sigma	0.333
	MDA	0.210
	K-40 (pCi/g)	2.495
	+/- 2 sigma	0.358
	MDA	0.167
	Co-60	<MDA
	+/- 2 sigma	N/A
	MDA	0.022
	Cs-137 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.021
	Pb-212	<MDA
	+/- 2 sigma	N/A
	MDA	0.019
	Pb-214	<MDA
	+/- 2 sigma	N/A
	MDA	0.033
	Am-241	<MDA
	+/- 2 sigma	N/A
	MDA	0.029

Terrestrial Vegetation Radiological Monitoring
Vegetation Analysis Results

Station:	E40 - Barnwell Co., SC	
Sample Date:		05/24/07
Radionuclides	Tritium (pCi/L)	<LLD
	+/- 2 sigma	N/A
	LLD	199
	Be-7 (pCi/g)	0.702
	+/- 2 sigma	0.290
	MDA	0.283
	K-40 (pCi/g)	3.512
	+/- 2 sigma	0.375
	MDA	0.139
	Co-60	<MDA
	+/- 2 sigma	N/A
	MDA	0.015
	Cs-137 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.017
	Pb-212	<MDA
	+/- 2 sigma	N/A
	MDA	0.037
	Pb-214	<MDA
	+/- 2 sigma	N/A
	MDA	0.048
	Am-241	<MDA
	+/- 2 sigma	N/A
	MDA	0.142

Station:	E41 - Aiken Co., SC	
Sample Date:		05/24/07
Radionuclides	Tritium (pCi/L)	<LLD
	+/- 2 sigma	N/A
	LLD	199
	Be-7 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.264
	K-40 (pCi/g)	3.834
	+/- 2 sigma	0.355
	MDA	0.127
	Co-60	<MDA
	+/- 2 sigma	N/A
	MDA	0.016
	Cs-137 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.017
	Pb-212	<MDA
	+/- 2 sigma	N/A
	MDA	0.035
	Pb-214	0.112
	+/- 2 sigma	0.035
	MDA	0.031
	Am-241	<MDA
	+/- 2 sigma	N/A
	MDA	0.130

Terrestrial Vegetation Radiological Monitoring
Vegetation Analysis Results

Station:	E43 - Bamberg Co., SC	
Sample Date:		05/24/07
Radionuclides	Tritium (pCi/L)	<LLD
	+/- 2 sigma	N/A
	LLD	199
	Be-7 (pCi/g)	1.003
	+/- 2 sigma	0.331
	MDA	0.281
	K-40 (pCi/g)	2.687
	+/- 2 sigma	0.355
	MDA	0.131
	Co-60	<MDA
	+/- 2 sigma	N/A
	MDA	0.017
	Cs-137 (pCi/g)	0.045
	+/- 2 sigma	0.018
	MDA	0.016
	Pb-212	<MDA
	+/- 2 sigma	N/A
	MDA	0.037
	Pb-214	<MDA
	+/- 2 sigma	N/A
	MDA	0.041
	Am-241	<MDA
	+/- 2 sigma	N/A
	MDA	0.141

Station:	B38 - Laurens Co., SC	
Sample Date:		05/22/07
Radionuclides	Tritium (pCi/L)	<LLD
	+/- 2 sigma	N/A
	LLD	199
	Be-7 (pCi/g)	0.743
	+/- 2 sigma	0.328
	MDA	0.275
	K-40 (pCi/g)	4.647
	+/- 2 sigma	0.438
	MDA	0.117
	Co-60	<MDA
	+/- 2 sigma	N/A
	MDA	0.015
	Cs-137 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.017
	Pb-212	0.073
	+/- 2 sigma	0.021
	MDA	0.032
	Pb-214	0.102
	+/- 2 sigma	0.031
	MDA	0.033
	Am-241	<MDA
	+/- 2 sigma	N/A
	MDA	0.134

Terrestrial Vegetation Radiological Monitoring
Vegetation Analysis Results

Station:	B40 - Laurens Co., SC	
Sample Date:		05/22/07
Radionuclides	Tritium (pCi/L)	<LLD
	+/- 2 sigma	N/A
	LLD	199
	Be-7 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.291
	K-40 (pCi/g)	4.572
	+/- 2 sigma	0.429
	MDA	0.144
	Co-60	<MDA
	+/- 2 sigma	N/A
	MDA	0.018
	Cs-137 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.017
	Pb-212	<MDA
	+/- 2 sigma	N/A
	MDA	0.038
	Pb-214	<MDA
	+/- 2 sigma	N/A
	MDA	0.034
	Am-241	<MDA
	+/- 2 sigma	N/A
	MDA	0.149

Station:	B47 - Laurens Co., SC	
Sample Date:		05/22/07
Radionuclides	Tritium (pCi/L)	<LLD
	+/- 2 sigma	N/A
	LLD	199
	Be-7 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.286
	K-40 (pCi/g)	4.601
	+/- 2 sigma	0.418
	MDA	0.120
	Co-60	<MDA
	+/- 2 sigma	N/A
	MDA	0.016
	Cs-137 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.017
	Pb-212	<MDA
	+/- 2 sigma	N/A
	MDA	0.036
	Pb-214	<MDA
	+/- 2 sigma	N/A
	MDA	0.040
	Am-241	<MDA
	+/- 2 sigma	N/A
	MDA	0.133

Terrestrial Vegetation Radiological Monitoring
Vegetation Analysis Results

Station:	E42 - Saluda Co., SC	
Sample Date:		08/23/07
Radionuclides	Tritium (pCi/L)	<LLD
	+/- 2 sigma	N/A
	LLD	209
	Be-7 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.904
	K-40 (pCi/g)	2.316
	+/- 2 sigma	0.342
	MDA	0.159
	Co-60	<MDA
	+/- 2 sigma	N/A
	MDA	0.018
	Cs-137 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.019
	Pb-212	<MDA
	+/- 2 sigma	N/A
	MDA	0.040
	Pb-214	<MDA
	+/- 2 sigma	N/A
	MDA	0.045
	Am-241	<MDA
	+/- 2 sigma	N/A
	MDA	0.147

Station:	E47 - Lexington Co., SC	
Sample Date:		08/23/07
Radionuclides	Tritium (pCi/L)	<LLD
	+/- 2 sigma	N/A
	LLD	209
	Be-7 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.958
	K-40 (pCi/g)	3.302
	+/- 2 sigma	0.356
	MDA	0.147
	Co-60	<MDA
	+/- 2 sigma	N/A
	MDA	0.020
	Cs-137 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.020
	Pb-212	<MDA
	+/- 2 sigma	N/A
	MDA	0.043
	Pb-214	<MDA
	+/- 2 sigma	N/A
	MDA	0.050
	Am-241	<MDA
	+/- 2 sigma	N/A
	MDA	0.137

Terrestrial Vegetation Radiological Monitoring
Vegetation Analysis Results

Station:	E50 - Lexington Co., SC	
Sample Date:		08/23/07
Radionuclides	Tritium (pCi/L)	<LLD
	+/- 2 sigma	N/A
	LLD	209
	Be-7 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	1.105
	K-40 (pCi/g)	4.250
	+/- 2 sigma	0.427
	MDA	0.139
	Co-60	<MDA
	+/- 2 sigma	N/A
	MDA	0.023
	Cs-137 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.019
	Pb-212	<MDA
	+/- 2 sigma	N/A
	MDA	0.043
	Pb-214	0.060
	+/- 2 sigma	0.029
	MDA	0.041
	Am-241	<MDA
	+/- 2 sigma	N/A
	MDA	0.146

Station:	B37 - McCormick Co., SC	
Sample Date:		08/22/07
Radionuclides	Tritium (pCi/L)	<LLD
	+/- 2 sigma	N/A
	LLD	209
	Be-7 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.942
	K-40 (pCi/g)	2.430
	+/- 2 sigma	0.339
	MDA	0.156
	Co-60	<MDA
	+/- 2 sigma	N/A
	MDA	0.018
	Cs-137 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.019
	Pb-212	<MDA
	+/- 2 sigma	N/A
	MDA	0.044
	Pb-214	<MDA
	+/- 2 sigma	N/A
	MDA	0.051
	Am-241	<MDA
	+/- 2 sigma	N/A
	MDA	0.147

Terrestrial Vegetation Radiological Monitoring
Vegetation Analysis Results

Station:	B45 - Anderson Co., SC	
Sample Date:		08/22/07
Radionuclides	Tritium (pCi/L)	<LLD
	+/- 2 sigma	N/A
	LLD	209
	Be-7 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	1.057
	K-40 (pCi/g)	4.988
	+/- 2 sigma	0.482
	MDA	0.172
	Co-60	<MDA
	+/- 2 sigma	N/A
	MDA	0.021
	Cs-137 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.018
	Pb-212	<MDA
	+/- 2 sigma	N/A
	MDA	0.043
	Pb-214	<MDA
	+/- 2 sigma	N/A
	MDA	0.049
	Am-241	<MDA
	+/- 2 sigma	N/A
	MDA	0.151

Station:	B46 - Oconee Co., SC	
Sample Date:		08/22/07
Radionuclides	Tritium (pCi/L)	<LLD
	+/- 2 sigma	N/A
	LLD	209
	Be-7 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.876
	K-40 (pCi/g)	3.740
	+/- 2 sigma	0.381
	MDA	0.120
	Co-60	<MDA
	+/- 2 sigma	N/A
	MDA	0.017
	Cs-137 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.017
	Pb-212	<MDA
	+/- 2 sigma	N/A
	MDA	0.039
	Pb-214	0.068
	+/- 2 sigma	0.029
	MDA	0.034
	Am-241	<MDA
	+/- 2 sigma	N/A
	MDA	0.131

Terrestrial Vegetation Radiological Monitoring
Vegetation Analysis Results

Station:	E45 - Hampton Co., SC	
Sample Date:		11/06/07
Radionuclides	Tritium (pCi/L)	<LLD
	+/- 2 sigma	N/A
	LLD	183
	Be-7 (pCi/g)	1.099
	+/- 2 sigma	0.366
	MDA	0.379
	K-40 (pCi/g)	3.969
	+/- 2 sigma	0.413
	MDA	0.151
	Co-60	<MDA
	+/- 2 sigma	N/A
	MDA	0.019
	Cs-137 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.018
	Pb-212	<MDA
	+/- 2 sigma	N/A
	MDA	0.040
	Pb-214	<MDA
	+/- 2 sigma	N/A
	MDA	0.045
	Am-241	<MDA
	+/- 2 sigma	N/A
	MDA	0.139

Station:	E46 - Orangeburg Co., SC	
Sample Date:		11/29/07
Radionuclides	Tritium (pCi/L)	<LLD
	+/- 2 sigma	N/A
	LLD	187
	Be-7 (pCi/g)	1.897
	+/- 2 sigma	0.356
	MDA	0.255
	K-40 (pCi/g)	1.441
	+/- 2 sigma	0.260
	MDA	0.146
	Co-60	<MDA
	+/- 2 sigma	N/A
	MDA	0.015
	Cs-137 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.016
	Pb-212	<MDA
	+/- 2 sigma	N/A
	MDA	0.039
	Pb-214	0.126
	+/- 2 sigma	0.031
	MDA	0.031
	Ac-228	0.284
	+/- 2 sigma	0.054
	MDA	0.053
	Am-241	<MDA
	+/- 2 sigma	N/A
	MDA	0.129

Terrestrial Vegetation Radiological Monitoring
Vegetation Analysis Results

Station:	E48 - Orangeburg Co., SC	
Sample Date:		11/29/07
Radionuclides	Tritium (pCi/L)	<LLD
	+/- 2 sigma	N/A
	LLD	187
	Be-7 (pCi/g)	1.372
	+/- 2 sigma	0.326
	MDA	0.266
	K-40 (pCi/g)	1.655
	+/- 2 sigma	0.259
	MDA	0.118
	Co-60	<MDA
	+/- 2 sigma	N/A
	MDA	0.015
	Cs-137 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.015
	Pb-212	<MDA
	+/- 2 sigma	N/A
	MDA	0.035
	Pb-214	0.190
	+/- 2 sigma	0.034
	MDA	0.031
	Am-241	<MDA
	+/- 2 sigma	N/A
	MDA	0.129

Station:	B39 - Saluda Co., SC	
Sample Date:		11/20/07
Radionuclides	Tritium (pCi/L)	<LLD
	+/- 2 sigma	N/A
	LLD	187
	Be-7 (pCi/g)	1.041
	+/- 2 sigma	0.274
	MDA	0.262
	K-40 (pCi/g)	4.099
	+/- 2 sigma	0.393
	MDA	0.126
	Co-60	<MDA
	+/- 2 sigma	N/A
	MDA	0.014
	Cs-137 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.015
	Pb-212	<MDA
	+/- 2 sigma	N/A
	MDA	0.033
	Pb-214	<MDA
	+/- 2 sigma	N/A
	MDA	0.038
	Am-241	<MDA
	+/- 2 sigma	N/A
	MDA	0.115

Terrestrial Vegetation Radiological Monitoring
Vegetation Analysis Results

Station:	B41 - Lexington Co., SC	
Sample Date:		11/20/07
Radionuclides	Tritium (pCi/L)	<LLD
	+/- 2 sigma	N/A
	LLD	187
	Be-7 (pCi/g)	1.182
	+/- 2 sigma	0.258
	MDA	0.269
	K-40 (pCi/g)	3.448
	+/- 2 sigma	0.350
	MDA	0.114
	Co-60	<MDA
	+/- 2 sigma	N/A
	MDA	0.015
	Cs-137 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.016
	Pb-212	<MDA
	+/- 2 sigma	N/A
	MDA	0.032
	Pb-214	<MDA
	+/- 2 sigma	N/A
	MDA	0.040
	Am-241	<MDA
	+/- 2 sigma	N/A
	MDA	0.117

Station:	B43 - Clarendon Co., SC	
Sample Date:		11/20/07
Radionuclides	Tritium (pCi/L)	<LLD
	+/- 2 sigma	N/A
	LLD	187
	Be-7 (pCi/g)	1.019
	+/- 2 sigma	0.298
	MDA	0.268
	K-40 (pCi/g)	1.332
	+/- 2 sigma	0.211
	MDA	0.096
	Co-60	<MDA
	+/- 2 sigma	N/A
	MDA	0.015
	Cs-137 (pCi/g)	<MDA
	+/- 2 sigma	N/A
	MDA	0.015
	Pb-212	<MDA
	+/- 2 sigma	N/A
	MDA	0.031
	Pb-214	<MDA
	+/- 2 sigma	N/A
	MDA	0.028
	Am-241	<MDA
	+/- 2 sigma	N/A
	MDA	0.104

Terrestrial Vegetation Radiological Monitoring
Fungi Analysis Results (pCi/g)

Fungi Random Quadrants in South Carolina Background

Isotope	B38	B39	B40	B42	B43	B44	B45	B46	B47	B48	B49	B51
Be-7	<MDA	**4.22**	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	**1.84**	<MDA	**1.85**	<MDA
MDA	0.76	0.65	0.79	2.46	0.80	1.66	1.41	1.73	0.71	1.83	0.87	2.93
NA-22	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.04	0.04	0.05	0.06	0.04	0.05	0.04	0.06	0.04	0.07	0.04	0.07
K-40	<MDA	**7.08**	**4.36**	**4.88**	<MDA	**4.13**	**2.47**	**4.46**	<MDA	**2.42**	**3.48**	**3.73**
MDA	0.37	0.31	0.36	0.57	0.33	0.47	0.35	0.41	0.34	0.46	0.30	0.52
Mn-54	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.05	0.04	0.05	0.09	0.04	0.06	0.04	0.07	0.04	0.07	0.04	0.08
Co-58	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.08	0.07	0.08	0.19	0.07	0.12	0.11	0.14	0.07	0.14	0.08	0.18
Co-60	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.04	0.04	0.04	0.07	0.04	0.06	0.04	0.05	0.04	0.06	0.04	0.06
Zn-65	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.12	0.12	0.13	0.16	0.09	0.13	0.11	0.14	0.12	0.16	0.10	0.20
Y-88	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.06	0.05	0.07	0.14	0.06	0.11	0.08	0.10	0.06	0.11	0.06	0.13
Zr-95	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.14	0.13	0.15	0.36	0.14	0.24	0.21	0.28	0.13	0.28	0.15	0.34
Ru-103	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.12	0.11	0.13	0.44	0.14	0.32	0.25	0.38	0.12	0.35	0.15	0.49
Sb-125	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.11	0.10	0.11	0.21	0.10	0.15	0.11	0.14	0.10	0.18	0.01	0.19
I-131	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	>8hle	>8hle	>8hle	>8hle	>8hle	>8hle	>8hle	>8hle	>8hle	>8hle	>8hle	>8hle
Cs-134	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.05	0.04	0.05	0.06	0.04	0.06	0.04	0.05	0.04	0.06	0.04	0.07
Cs-137	<MDA	<MDA	<MDA	**1.20**	<MDA	<MDA	<MDA	**0.34**	<MDA	**1.73**	<MDA	**1.57**
MDA	0.04	0.04	0.05	0.06	0.04	0.06	0.04	0.05	0.04	0.06	0.04	0.06
Ce-144	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.23	0.21	0.22	0.57	0.27	0.43	0.32	0.42	0.20	0.49	0.28	0.57
Eu-152	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.07	0.06	0.07	0.16	0.09	0.13	0.09	0.13	0.06	0.16	0.09	0.18
Eu-154	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.05	0.04	0.05	0.12	0.06	0.09	0.07	0.09	0.04	0.11	0.07	0.13
Eu-155	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.08	0.07	0.07	0.26	0.14	0.21	0.14	0.20	0.06	0.22	0.15	0.26
Pb-212	<MDA	**0.45**	**0.21**	<MDA	<MDA	<MDA	<MDA	**0.32**	**0.09**	<MDA	<MDA	<MDA
MDA	0.03	0.03	0.03	0.11	0.07	0.01	0.07	0.08	0.02	0.12	0.08	0.14
Pb-214	**0.21**	**0.59**	**0.25**	<MDA	**0.22**	**0.25**	<MDA	**0.55**	**0.23**	**0.54**	**0.42**	<MDA
MDA	0.08	0.06	0.07	0.14	0.07	0.11	0.09	0.09	0.07	0.12	0.08	0.16
Ra-226	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.67	0.61	0.77	1.53	0.91	1.35	0.89	1.18	0.70	1.44	0.94	1.68
Ac-228	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.20	0.18	0.18	0.31	0.16	0.28	0.16	0.30	0.16	0.24	0.19	0.30
U/Th-238	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.43	0.40	0.50	3.20	0.87	1.29	0.90	1.15	0.45	1.48	0.90	3.17
Am-241	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.06	0.06	0.06	0.89	0.46	0.73	0.46	0.66	0.06	0.84	0.47	0.90

Terrestrial Vegetation Radiological Monitoring
Fungi Analysis Results (pCi/g)

Fungi Random Quadrants Within 50-Mile Perimeter

Isotope	E40	E41	E42	E43	E44	E45	E46	E47	E49	E51
Be-7	**2.97**	**4.02**	**8.19**	<MDA	<MDA	**1.31**	<MDA	**2.36**	<MDA	<MDA
MDA	1.58	1.56	3.01	1.94	17.97	0.68	1.45	0.33	7.85	1.97
NA-22	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.07	0.05	0.15	0.10	0.09	0.05	0.07	0.04	0.07	0.08
K-40	**3.06**	**1.40**	<MDA	**20.77**	<MDA	**20.15**	**16.62**	**1.58**	**0.66**	**4.84**
MDA	0.54	0.41	1.37	0.60	0.75	0.37	0.63	0.34	0.46	0.71
Mn-54	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.08	0.06	0.16	0.08	0.12	0.04	0.07	0.04	0.08	0.10
Co-58	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.15	0.13	0.29	0.14	0.28	0.06	0.12	0.04	0.40	0.18
Co-60	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.08	0.05	0.14	0.08	0.09	0.05	0.07	0.04	0.05	0.08
Zn-65	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.19	0.12	0.50	0.23	0.26	0.11	0.16	0.08	0.21	0.22
Y-88	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.08	0.07	0.21	0.09	0.17	0.05	0.08	0.04	0.22	0.12
Zr-95	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.29	0.26	0.53	0.28	0.62	0.13	0.21	0.07	0.95	0.34
Ru-103	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.26	0.29	0.47	0.30	3.16	0.11	0.18	0.05	2.81	0.33
Sb-125	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.17	0.14	0.38	0.20	1.34	0.12	0.22	0.09	0.16	0.23
I-131	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	>8hle	>8hle	>8hle	>8hle	>8hle	6.75	12.55	0.20	>8hle	>8hle
Cs-134	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.07	0.05	0.18	0.07	0.13	0.04	0.06	0.03	0.06	0.08
Cs-137	**0.54**	**0.21**	**0.29**	**3.25**	<MDA	**0.34**	**1.10**	<MDA	**0.08**	**0.79**
MDA	0.06	0.05	0.15	0.07	0.19	0.04	0.08	0.04	0.05	0.07
Ce-144	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.31	0.39	0.81	0.33	8.56	0.29	0.53	0.15	0.44	0.39
Eu-152	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.10	0.12	0.25	0.10	0.50	0.10	0.17	0.05	0.10	0.12
Eu-154	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.07	0.08	0.17	0.07	0.23	0.07	0.12	0.03	0.07	0.09
Eu-155	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.12	0.18	0.25	0.12	3.90	0.15	0.27	0.06	0.13	0.14
Pb-212	<MDA	<MDA	**0.34**	<MDA	<MDA	<MDA	<MDA	**0.10**	<MDA	<MDA
MDA	0.06	0.10	0.09	0.06	2.80	0.07	0.14	0.02	0.05	0.08
Pb-214	<MDA	**0.18**	**0.93**	<MDA	<MDA	**0.24**	**0.48**	**0.16**	<MDA	<MDA
MDA	0.15	0.09	0.26	0.14	1.91	0.07	0.15	0.06	0.12	0.17
Ra-226	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	1.11	1.05	2.66	1.16	28.95	0.85	1.69	0.65	1.00	1.43
Ac-228	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.27	0.25	0.61	0.30	0.50	0.18	0.34	0.17	0.22	0.34
U/Th-238	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.67	2.16	1.72	0.64	39.10	1.72	3.23	0.36	1.13	0.78
Am-241	<MDA	<MDA	<MDA	<MDA	LE	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.09	0.63	0.22	0.09	LE	0.54	0.90	0.05	0.24	0.11

Terrestrial Vegetation Radiological Monitoring
Fungi Analysis Results (pCi/g)

Fungi Nonrandom (NR) Sample Results Within 10 miles of a Nuclear Facility (NF).

Location	NR1A	NR1B	NR2	NR3	NR4	NR5	NR6	NR7	NR8	NR9	NR10	NR11	NR13
Isotope	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
Be-7	<MDA	**4.99**	<MDA	<MDA	<MDA	**2.48**	**1.70**	**3.68**	<MDA	**6.42**	**2.52**	<MDA	**9.11**
MDA	1.54	1.49	2.72	1.17	1.06	0.57	0.65	0.64	1.12	1.02	1.19	1.22	3.12
NA-22	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.08	0.07	0.11	0.06	0.06	0.05	0.05	0.05	0.07	0.10	0.04	0.04	0.11
K-40	<MDA	**2.19**	<MDA	<MDA	**2.37**	**1.84**	**12.75**	**2.41**	<MDA	<MDA	**1.86**	<MDA	**3.20**
MDA	0.62	0.52	2.46	0.45	0.49	0.36	0.37	0.40	1.60	0.67	0.33	0.31	0.90
Mn-54	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.07	0.07	0.09	0.06	0.06	0.04	0.05	0.05	0.07	0.08	0.04	0.04	0.13
Co-58	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.14	0.14	0.21	0.11	0.10	0.06	0.07	0.07	0.10	0.12	0.09	0.09	0.25
Co-60	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.07	0.07	0.10	0.06	0.06	0.04	0.05	0.05	0.06	0.07	0.04	0.03	0.12
Zn-65	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.18	0.18	0.26	0.14	0.14	0.10	0.12	0.11	0.17	0.19	0.10	0.10	0.29
Y-88	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.11	0.10	0.18	0.09	0.08	0.05	0.06	0.06	0.09	0.10	0.06	0.06	0.19
Zr-95	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.28	0.29	0.44	0.23	0.20	0.12	0.14	0.13	0.20	0.21	0.19	0.20	0.52
Ru-103	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.24	0.29	0.44	0.22	0.17	0.09	0.10	0.10	0.15	0.15	0.23	0.23	0.50
Sb-125	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.16	0.18	0.25	0.13	0.14	0.10	0.11	0.11	0.17	0.19	0.10	0.11	0.35
I-131	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	>8hle	>8hle	>8hle	>8hle	>8hle	4.41	5.35	4.17	7.00	5.52	>8hle	>8hle	>8hle
Cs-134	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.06	0.07	0.10	0.05	0.05	0.04	0.04	0.04	0.07	0.07	0.04	0.04	0.12
Cs-137	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	**1.12**
MDA	0.07	0.06	0.10	0.05	0.06	0.04	0.04	0.04	0.08	0.08	0.04	0.04	0.13
Ce-144	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.30	0.31	0.45	0.23	0.25	0.17	0.20	0.18	0.35	0.34	0.31	0.30	1.02
Eu-152	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.09	0.09	0.14	0.07	0.07	0.05	0.06	0.06	0.10	0.11	0.10	0.09	0.32
Eu-154	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.06	0.06	0.10	0.05	0.05	0.04	0.04	0.04	0.07	0.08	0.07	0.06	0.21
Eu-155	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.11	0.12	0.17	0.09	0.10	0.07	0.09	0.08	0.16	0.13	0.14	0.14	0.47
Pb-212	<MDA	**0.12**	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	**0.15**	<MDA	<MDA	<MDA	<MDA
MDA	0.06	0.04	0.10	0.05	0.05	0.04	0.03	0.04	0.06	0.07	0.08	0.08	0.26
Pb-214	<MDA	<MDA	<MDA	<MDA	**0.25**	**0.18**	**0.54**	<MDA	**0.54**	<MDA	**0.21**	**0.26**	**0.80**
MDA	0.15	0.15	0.17	0.10	0.10	0.07	0.08	0.08	0.12	0.17	0.07	0.07	0.24
Ra-226	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	1.16	1.11	1.70	0.85	0.94	0.67	0.65	0.76	0.99	1.37	0.85	0.81	2.89
Ac-228	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.25	0.30	0.45	0.22	0.22	0.17	0.29	0.19	0.36	0.33	0.17	0.17	0.58
U/Th-238	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.63	0.65	0.96	0.50	0.53	0.38	0.51	0.43	0.90	0.79	1.66	1.70	5.98
Am-241	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.09	0.09	0.13	0.07	0.07	0.05	0.07	0.06	0.13	0.11	0.46	0.48	1.69

Terrestrial Vegetation Radiological Monitoring
Fungi Analysis Results

Back to List of Data Tables

Fungi Nonrandom Background (NRB) Samples (pCi/g)

Location	NR12	NR14	NR15	SHEF	SHWF
Isotope	NRB	NRB	NRB	NRB	NRB
Be-7	<MDA	<MDA	<MDA	**5.84**	**2.87**
MDA	2.00	2.70	2.76	1.11	0.81
NA-22	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.06	0.10	0.10	0.08	0.08
K-40	**3.94**	**17.50**	**2.08**	<MDA	<MDA
MDA	0.45	0.79	0.85	0.74	1.70
Mn-54	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.07	0.11	0.11	0.06	0.08
Co-58	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.16	0.22	0.22	0.09	0.09
Co-60	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.06	0.09	0.11	0.08	0.08
Zn-65	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.15	0.29	0.30	0.17	0.18
Y-88	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.10	0.15	0.17	0.09	0.08
Zr-95	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.31	0.43	0.45	0.16	0.17
Ru-103	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.44	0.51	0.51	0.15	0.11
Sb-125	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.15	0.24	0.26	0.27	0.16
I-131	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	>8hle	>8hle	>8hle	1.02	0.97
Cs-134	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.05	0.10	0.11	0.08	0.07
Cs-137	**0.27**	**1.10**	**0.23**	**7.82**	**0.15**
MDA	0.06	0.09	0.08	0.08	0.07
Ce-144	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.43	0.49	0.51	0.36	0.31
Eu-152	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.14	0.14	0.14	0.13	0.11
Eu-154	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.09	0.10	0.10	0.09	0.08
Eu-155	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.21	0.14	0.15	0.14	0.13
Pb-212	**0.40**	<MDA	**0.15**	<MDA	0.10
MDA	0.09	0.06	0.06	0.08	0.05
Pb-214	**0.41**	<MDA	**0.46**	<MDA	**0.56**
MDA	0.10	0.16	0.17	0.19	0.14
Ra-226	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	1.07	1.55	1.47	1.57	1.12
Ac-228	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.32	0.36	0.37	0.32	0.37
U/Th-238	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	1.32	1.02	1.06	0.80	0.75
Am-241	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.72	0.13	0.14	0.11	0.10

3.2.5 Summary Statistics

Vegetation Summary **295**

Fungi Summary **297**

Notes:

1. pCi/L - picocuries per liter
2. pCi/g - picocuries per gram
3. ND denotes non-detect
4. N/A denotes not applicable
5. Std Dev – standard deviation
6. LLD - Lower Limit of Detection
7. MDA - Minimum Detectable Activity
8. >8hle – Indicates no determination due to greater than 8 half-lives elapsed
9. See List of Acronymsfor radionuclide definitions

Back to List of Summary Statistics

Terrestrial Vegetation Radiological Monitoring
Vegetation Summary

Tritium Levels (pCi/L) from SRS Perimeter Stations, 2007

Station	N (ND)	Average	Std Dev	Median	Minimum	Maximum
AKN-001	3 (1)	474	138	497	326	599
AKN-002	4 (0)	440	197	457	221	623
AKN-003	2 (2)	626	160	626	513	739
AKN-004	4 (0)	349	143	333	191	538
AKN-005	3 (1)	666	355	465	547	1076
AKN-006	3 (1)	695	434	639	291	1154
AKN-007	2 (2)	303	100	303	232	374
BWL-001	3 (1)	596	480	465	195	1127
BWL-002	4 (0)	586	394	531	249	1032
BWL-003	3 (1)	339	116	365	212	440
BWL-004	2 (2)	533	188	533	400	666
ALD-001	1 (3)	389	N/A	389	389	389
BWL-006	2 (2)	765	492	765	417	1113
BWL-007	4 (0)	340	111	349	197	467
BWL-008	4 (0)	914	704	717	320	1901
BWL-009	4 (0)	693	428	552	352	1318

Averages exclude non-detects

Cesium-137 Levels (pCi/g) from SRS Perimeter Stations, 2007

Station	N (ND)	Average	Std Dev	Median	Minimum	Maximum
AKN-001	3 (1)	0.172	0.061	0.184	0.107	0.227
AKN-002	0 (4)	N/A	N/A	N/A	N/A	N/A
AKN-003	4 (0)	0.850	0.484	0.924	0.212	1.342
AKN-005	4 (0)	0.629	0.166	0.616	0.449	0.836
AKN-006	4 (0)	0.111	0.042	0.122	0.050	0.149
AKN-008	4 (0)	0.596	0.214	0.557	0.398	0.872
BWL-004	4 (0)	0.164	0.031	0.154	0.141	0.208
ALD-001	4 (0)	0.269	0.211	0.207	0.089	0.574
BWL-006	4 (0)	0.596	0.279	0.559	0.347	0.917

Averages exclude non-detects

Tritium Levels (pCi/L) in SRS Perimeter Vegetation Samples, 2007

N (ND)	Average	Std Dev	Median	Minimum	Maximum
48 (16)	544	185	481	191	1901

Average excludes non-detects

Cs-137 Levels (pCi/g) in SRS Perimeter Vegetation Samples, 2007

N (ND)	Average	Std Dev	Median	Minimum	Maximum
31 (5)	0.423	0.151	0.382	0.050	1.342

Average excludes non-detects

Terrestrial Vegetation Radiological Monitoring
Vegetation Summary

Tritium Levels (pCi/L) in 25-mile Radius Vegetation Samples, 2007

N (ND)	Average	Std Dev	Median	Minimum	Maximum
6 (6)	296	62	291	224	371

Average excludes non-detects

Tritium Levels (pCi/L) in 50-mile Radius Vegetation Samples, 2007

N (ND)	Average*	Std Dev*	Median*	Minimum	Maximum
0 (12)	99	4	99	N/A	N/A

* Includes non-detects calculated as LLD x 0.5

Tritium Levels (pCi/L) in S.C. Background Vegetation Samples, 2007

N (ND)	Average*	Std Dev*	Median*	Minimum	Maximum
0 (12)	99	4	99	N/A	N/A

* Includes non-detects calculated as LLD x 0.5

Cs-137 Levels (pCi/g) in 50-mile Radius Vegetation Samples, 2007

N (ND)	Average*	Std Dev*	Median*	Minimum	Maximum
2 (10)	0.019	0.024	0.009	N/A	0.089

* Includes non-detects calculated as MDA x 0.5

Cs-137 Levels (pCi/g) in S.C. Background Vegetation Samples, 2007

N (ND)	Average*	Std Dev*	Median*	Minimum	Maximum
0 (12)	0.009	0.001	0.009	N/A	N/A

* Includes non-detects calculated as MDA x 0.5

Terrestrial Vegetation Radiological Monitoring
Fungi Summary (pCi/g)

2007 Fungi Summary Statistics

Locations	Random SC Background			50-Mile SRS Perimeter			Nuclear Facility Samples			Nonrandom Backgrounds		
Isotope	**Avg**	**SD**	**Median**	**Avg**	**SD**	**Median**	Avg	SD	Median	**Avg**	**SD**	**Median**
Be-7	**2.64**	**1.37**	**1.85**	**3.77**	**2.66**	**2.97**	**4.41**	**2.63**	**3.68**	**4.35**	**2.10**	**4.35**
MDA	1.38	0.76	1.14	3.83	5.39	1.76	1.35	0.76	1.17	1.88	0.89	2.00
NA-22	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.05	0.01	0.04	0.08	0.03	0.07	0.07	0.03	0.06	0.08	0.02	0.08
K-40	**4.11**	**1.40**	**4.13**	**8.64**	**8.90**	**3.95**	**3.80**	**3.97**	**2.37**	**7.84**	**8.42**	**3.94**
MDA	0.40	0.09	0.37	0.62	0.30	0.57	0.73	0.62	0.49	0.90	0.47	0.79
Mn-54	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.06	0.02	0.05	0.08	0.04	0.08	0.07	0.03	0.06	0.09	0.03	0.08
Co-58	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.11	0.04	0.09	0.18	0.11	0.14	0.12	0.06	0.10	0.16	0.06	0.16
Co-60	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.05	0.01	0.04	0.07	0.03	0.07	0.06	0.02	0.06	0.08	0.02	0.08
Zn-65	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.13	0.03	0.13	0.21	0.12	0.20	0.16	0.06	0.14	0.22	0.07	0.18
Y-88	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.09	0.03	0.08	0.11	0.06	0.09	0.09	0.04	0.09	0.12	0.04	0.10
Zr-95	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.21	0.08	0.18	0.37	0.26	0.29	0.24	0.12	0.20	0.30	0.14	0.31
Ru-103	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.25	0.14	0.20	0.80	1.16	0.30	0.22	0.12	0.22	0.34	0.20	0.44
Sb-125	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.13	0.05	0.11	0.30	0.37	0.18	0.16	0.07	0.14	0.22	0.05	0.24
I-131	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	NA	NA	NA	6.50	6.18	6.75	5.29	1.12	5.35	0.99	0.04	0.99
Cs-134	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.05	0.01	0.05	0.08	0.04	0.07	0.06	0.02	0.05	0.08	0.02	0.08
Cs-137	**1.21**	**0.62**	**1.38**	**0.82**	**1.04**	**0.44**	**1.12**	**NA**	**1.12**	**1.92**	**3.32**	**0.27**
MDA	0.05	0.01	0.04	0.08	0.05	0.07	0.06	0.03	0.06	0.08	0.01	0.08
Ce-144	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.35	0.14	0.30	1.22	2.59	0.39	0.34	0.22	0.30	0.42	0.09	0.43
Eu-152	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.11	0.04	0.09	0.16	0.13	0.11	0.10	0.07	0.09	0.13	0.01	0.14
Eu-154	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.08	0.03	0.07	0.10	0.06	0.08	0.07	0.05	0.06	0.09	0.01	0.09
Eu-155	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.16	0.07	0.14	0.53	1.19	0.15	0.14	0.10	0.12	0.16	0.03	0.14
Pb-212	**0.27**	**0.15**	**0.26**	**0.22**	**0.17**	**0.22**	**0.14**	**0.02**	**0.14**	**0.22**	**0.16**	**0.15**
MDA	0.07	0.04	0.07	0.35	0.86	0.08	0.07	0.06	0.06	0.07	0.02	0.06
Pb-214	**0.36**	**0.16**	**0.25**	**0.40**	**0.32**	**0.24**	**0.40**	**0.23**	**0.26**	**0.47**	**0.08**	**0.46**
MDA	0.10	0.03	0.08	0.31	0.56	0.14	0.12	0.05	0.10	0.15	0.03	0.16
Ra-226	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	1.06	0.37	0.92	4.05	8.77	1.14	1.14	0.61	0.94	1.36	0.24	1.47
Ac-228	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.22	0.06	0.19	0.32	0.14	0.28	0.28	0.12	0.25	0.35	0.02	0.36
U/Th-238	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	1.23	0.98	0.90	5.15	11.96	1.42	1.20	1.50	0.65	0.99	0.23	1.02
Am-241	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
MDA	0.47	0.34	0.47	0.32	0.30	0.22	0.27	0.45	0.09	0.24	0.27	0.13

Terrestrial Vegetation Radiological Monitoring
Fungi Summary (pCi/g)

Back to List of Summary Statistics

7.5 Minute Quadrant Radionuclide Summary Statistics for Combined Samples

Random Plus Nonrandom Average Concentrations Found in Fungi by Quadrants (2007)											
SRS[4] 50-Mile Perimeter(E)					SC Background(B)>50-Mile				Results > SC Bkg[5]		Quadrant Basis
ID[1]	#D[2]	Avg	SD[3]	Median	#D[2]	Avg	SD[3]	Median	Average	Median	Max D[6]
Be-7	6	3.77	2.66	2.97	5	3.32	1.71	2.87	**0.45**	**0.1**	8.19_E42pm
Cs-137	10	0.82	1.04	0.44	6	1.6	2.41	1.1	<SCBkg	<SCBkg	7.82 SHEF
K-40	10	8.64	8.9	3.95	10	5.04	4.14	4.03	**3.6**	<SCBkg	20.77_E43Lcp
Pb-212	2	0.22	0.17	0.22	6	0.24	0.15	0.21	<SCBkg	**0.01**	0.45_B39pm
Pb-214	8	0.4	0.32	0.24	11	0.39	0.15	0.41	**0.01**	<SCBkg	0.93_E42pm
All SC Random Plus Nonrandom Fungi by Quadrants (2004-2007)											
SRS[4] 50-Mile Perimeter(E)					SC Background(B)>50-Mile				Results > SC Bkg[5]		Quadrant Basis
ID[1]	#D[2]	Avg	SD[3]	Median	#D[2]	Avg	SD[3]	Median	Average	Median	Max D[6]
Ac-228	1	2.34	NA	2.34	0	<MDA	<MDA	<MDA	**2.34**	**2.34**	2.34_E6ucp
Be-7	13	4.31	3.30	2.97	17	4.12	2.83	3.18	**0.19**	**<SCBkg**	12.51_B14pm
Cs-137	39	1.46	1.94	0.92	34	0.99	1.50	0.46	**0.47**	**0.46**	10.87_E31ucp
Eu-155	1	0.71	NA	0.71	0	<MDA	<MDA	<MDA	**0.71**	**0.71**	0.71_E6ucp
K-40	40	7.95	7.31	5.57	39	5.19	5.00	3.83	**2.76**	**1.74**	29.31_B83pm
Pb-212	8	0.29	0.22	0.25	9	0.22	0.14	0.16	**0.07**	**0.09**	0.62_Eucp
Pb-214	25	0.67	0.72	0.34	25	0.35	0.14	0.30	**0.32**	**0.04**	3.30_E6ucp
Ra-226	4	5.78	3.01	4.59	2	1.52	2.08	1.52	**4.26**	**3.07**	10.23_E6ucp
SC Coastal Plain Random plus Nonrandom Fungi by Quadrants (2004-2007)											
SRS[4] 50-Mile Perimeter(E)					SC Background(B)>50-Mile				Results > SC Bkg[5]		Quadrant Basis
ID[1]	#D[2]	Avg	SD[3]	Median	#D[2]	Avg	SD[3]	Median	Average	Median	Max D[6]
Ac-228	1	2.34	NA	2.34	0	<MDA	<MDA	<MDA	**2.34**	**2.34**	2.34_E6ucp
Be-7	11	4.13	3.34	2.97	7	3.23	1.49	3.18	**0.90**	**<SCBkg**	10.97_E14ucp
Cs-137	36	1.56	1.99	1.04	23	1.27	1.76	0.68	**0.29**	**0.36**	10.87_E31ucp
Eu-155	1	0.71	NA	0.71	0	<MDA	<MDA	<MDA	**0.71**	**0.71**	0.71_E6ucp
K-40	33	8.33	7.44	5.70	19	5.23	3.62	3.79	**3.10**	**1.91**	27.80_E60ucp
Pb-212	7	0.29	0.24	0.16	3	0.10	0.04	0.10	**0.19**	**0.06**	0.62_Eucp
Pb-214	21	0.67	0.77	0.34	13	0.35	0.16	0.31	**0.32**	**0.03**	3.30_E6ucp
Ra-226	3	6.47	3.28	5.02	1	2.99	NA	2.99	**3.48**	**2.03**	10.23_E6ucp
SC Upper Coastal Plain Random plus Nonrandom Fungi by Quadrants (2004-2007)											
SRS[4] 50-Mile Perimeter(E)					SC Background(B)>50-Mile				Results > SC Bkg[5]		Quadrant Basis
ID[1]	#D[2]	Avg	SD[3]	Median	#D[2]	Avg	SD[3]	Median	Average	Median	Max D[6]
Ac-228	1	2.34	NA	2.34	3	<MDA	<MDA	<MDA	**2.34**	**2.34**	2.34_E6ucp
Be-7	8	5.10	3.47	3.76	3	4.32	1.49	4.28	**<SCBkg**	**<SCBkg**	10.97_E14ucp
Cs-137	24	1.66	2.06	1.21	4	2.18	3.76	0.37	**<SCBkg**	**0.84**	10.87_E31ucp
Eu-155	1	0.71	NA	0.71	0	<MDA	<MDA	<MDA	**0.71**	**0.71**	0.71_E6ucp
K-40	21	8.36	8.11	4.17	1	4.79	3.62	4.79	**3.57**	**<SCBkg**	27.80_E60ucp
Pb-212	6	0.32	0.25	0.28	1	0.10	NA	0.10	**0.22**	**0.18**	0.62_Eucp
Pb-214	15	0.79	0.88	0.48	2	0.43	0.18	0.43	**0.36**	**0.05**	3.30_E6ucp
Ra-226	3	6.47	3.28	5.02	0	<MDA	<MDA	<MDA	**6.47**	**5.02**	10.23_E6ucp

Notes: See acronyms and radionuclide lists for abbreviation recommendations.
1- ID is the radionuclide abbreviation. See glossary for abbreviation identification.
2- #D is the number of quadrants with detections.
3- sd is the standard deviation.
4- SRS 50-Mile perimeter is a circle 50-miles from a Savannah River Site centerpoint.
5- SCBkg is the South Carolina background outside of the SRS 50-mile perimeter.
6- Max D is the maximum quadrant average detection within the specified sampling time period.
7- <MDA is less than the minimum detectable activity for the radionuclide.
8-Additional sampling in quadrants in later years altered quadrant averages and maximums.
9-All data are in pCi/g and represent 7.5 minute quadrant results.
10-"pm" is piedmont, "cp" is coastal plain, "u" is upper, "NR" is nonrandom quadrant.

3.3 Radiological Monitoring of Edible Vegetation

3.3.1 Summary

Deposition on crops and other plants may result in entry of radionuclides into the food chain in several ways. One pathway is by direct absorption into the plant through the foliage; another is by ingestion of the contaminated plant by animals or man. Radionuclides deposited on plants may also be washed off and enter the ground where they can be taken up by plants or may enter aquatic systems (Kathren 1984). Plant uptake of radionuclides depends upon many factors including species, tissue type, soil-water-plant relationships, soil type, and the chemical nature of the radionuclide in the soil (Hanlon 2004). "Sampling and analyzing native vegetation can provide information about the presence and movement of radionuclides in the environment" (LLNL 1997).

The Radiological Monitoring of Edible Vegetation Project is a component of the South Carolina Department of Health and Environmental Control (SCDHEC)'s Environmental Surveillance and Oversight Program (ESOP) that monitors edible food products from perimeter and background locations around the Savannah River Site (SRS). SCDHEC ESOP addresses public concerns pertaining to SRS operations through independent monitoring of radionuclide activities in edible vegetation grown around the perimeter of SRS. Edible vegetation was collected based solely on availability, and was directly dependent upon the growing season. To gain access to samples, relationships are established on an ongoing basis with farmers, gardeners, and/or businesses surrounding the perimeter of SRS. Vegetation samples, such as wild plums, and pears were collected on public property.

Annual sampling began in January 2007 with ESOP collecting samples on a routine basis through the end of December using the random quadrant system for background (> 50 miles outside the perimeter of SRS) and environmental (< 50 miles from the perimeter of SRS) sampling (Map 1). In 2007, ESOP narrowed the types of edible vegetation sampled to parallel the Department of Energy-Savannah River (DOE-SR) program; better facilitating comparisons between the two programs. An agreement was established with three farming participants living around the perimeter of the SRS to be annual contributors of corn and/or watermelon to the project. In addition, six non-random perimeter sampling locations were re-established for collecting plums on an annual basis. Forty-one samples were collected from 33 sampling locations: nine randomly selected background locations, 18 randomly selected environmental locations, and six non-random perimeter locations.

The DOE-SR annually collects and analyzes terrestrial food products to determine the presence of gamma emitting radionuclides, tritium, strontium-89/90 (Sr-89/90), uranium-234 (U-234), uranium-235 (U-235), uranium-238 (U-238), plutonium-238 (Pu-238), plutonium-239 (Pu-239), americium-241 (Am-241), cobalt-60 (Co-60), curium-244 (Cm-244), gross alpha, and gross beta. In comparison, ESOP analyzes food products collected to determine the presence of gamma emitting radionuclides, tritium, Sr-89/90. The DOE-SR collects collards and watermelons annually from one location within each of four quadrants. In 2005, the inclusion of secondary crops began on a rotating schedule. Each year pecans, peanuts, soybeans, corn, cabbage, or wheat are (is) chosen to rotate into the collection process.

According to the DOE-SR reported data, edible vegetation samples collected in 2007 were found to have activities above the minimum detectable concentrations (MDC) for cesium-137 (Cs-137), and total strontium (Sr-89/90). These were the only data comparisons that could be made between ESOP and DOE-SR programs.

ESOP compared data against 13 edible vegetation samples reported by DOE-SR. Of these, DOE-SR had 10Cs-137 detections, and 3 Sr-89/90 detections. The two common food products between the ESOP and DOE-SR programs were greens and watermelon. However, the food product that could be compared between the two programs was greens because DOE-SR data indicates non-detects of tritium, Sr89/90 and only one detect of Cs-137 for watermelon. ESOP detected tritium for watermelon at one perimeter location (0.271 picocuries per gram (pCi/g)), and one background location (0.204 pCi/g) (Section 3.3.4). Neither Cs-137 nor Sr89/90 was detected in any of the ESOP fruit samples.

The DOE-SR data reflects that tritium detections in greens samples within their 0-10 mile quadrant from a total of five samples is well below the MDC. The DOE-SR data also indicates that there were 10 Cs-137 detections: greens at four locations, cabbage at three locations, and wheat at one location; were found at various locations within their 0-10 mile designated quadrants and one cabbage location from a designated control location within an extended (to 25 miles beyond the perimeter) southeast quadrant (WSRC 2008a).

For the 2008 sampling year, ESOP plans to continue sampling using the quadrant system format, seeks to establish more annual perimeter sampling locations to improve comparisons with DOE-SR.

RESULTS AND DISCUSSION

Tritium

Tritium is naturally present as a very small percentage of ordinary hydrogen in water, both liquid and vapor. As a result of natural processes in the atmosphere, tritium is present in water (liquid and vapor) (ANL 2005).

Historically, the main sources of tritium releases from the SRS operations were the reactor areas, the chemical separation facilities, and the tritium packaging areas. Because it moves through living cells in the same manner as water, tritiated water is more hazardous biologically than tritium gas. (CDC SRSHES 1997). Tritium releases on the SRS include both atmospheric and liquid contributions (WSRC 2008b).

Since 1988, when the last heavy water reactor at SRS was shut down, the tritium supply was re-established using the new Tritium Extraction Facility (TEF). This facility's mission is to transfer new tritium gas to the nation's tritium inventory (WSRC 2008b). Adjacent to the is the Southern Nuclear Operating Company which operates the Vogtle Electric Generating Plant (VEGP) located in Burke County, GA. Permitted tritium releases coming from the VEGP are a result of spent fuel pools during power operation, during reactor operation by the fission process, and

from fuel assemblies mainly during reactor operation and shortly after shutdown (Federal Register 1998).

In 2007, tritium was detected in 11 of the total 41ESOP samples collected across South Carolina. Of these 11 detections, six of these were within the 50-mile perimeter of the SRS. The highest detection from these perimeter samples, found in peaches from a Saluda location (Steedman), was 0.410 pCi/g. The lowest perimeter tritium detection found in a soybean sample from the Crocketville Quad, was 0.191 pCi/g. The tritium average for all edible vegetation from perimeter locations was 0.276 (±0.081) pCi/g with a median of 0.256 pCi/g. Of the background samples that ESOP collected, the highest tritium detection, found in a corn sample from the Gilbert quad, was 0.403 pCi/g. The ESOP tritium average for all edible vegetation from background locations was 0.301 (± 0.072) pCi/g with a median of 0.302 pCi/g.

The only two food products common in 2007 between the ESOP and the DOE-SR programs were collards and watermelon. The highest tritium and only detect in an ESOP collards sample, from Salley, SC, within 50 miles of SRS, was 0.240 pCi/g. The DOE-SR did not have any detections of tritium in fruit for 2007; therefore, a comparison could not be made between the two programs. Of the seven watermelon samples ESOP collected, tritium was detected in two samples. One sample from Steedman, SC had a detection of 0.271 pCi/g of tritium while a background sample from Gilbert (Leesville, SC) had a detection of 0.204 pCi/g in watermelon. Statistics were not performed on these fruit since there were only two detections. Five of the seven total samples collected had concentrations that were less than LLD.

During this sampling year, ESOP re-established six perimeter sampling locations for collecting plums (Aiken, Barnwell, Snelling, Allendale, Jackson, and New Ellenton).Sampling at these locations will be annual, providing an ongoing source of edible vegetation for the project. Tritium detections were less than the lower limit of detection in 2007 (Section 3.3.3). Between the years 2004-2007, ESOP collected 13 plum samples (Section 3.3.2, Table 2). Three of these had tritium detects. The tritium average was 0.453 (±0.303) pCi/g with a median of 0.284 pCi/g. The highest concentration was 0.803 pCi/g from a 2004 Snelling location. Cesium-137 was below the MDA for all the plum samples collected. In 2008, ESOP plans to analyze plums for Sr-89/90. Comparisons could not be made with DOE-SR since plums are not collected for this program. After sampling EVALN-01, the plum trees for this location were destroyed. Other plum trees will have to be located for collection from this sampling location in 2008.
From 2004-2007, 83 samples were collected across South Carolina. Of these, 25 SRS perimeter samples had detects of tritium with an average of 0.282 pCi/g. Twenty-six background samples were collected during this same time period. Six of these had detects of tritium with an average of 0.293 pCi/g. The overall tritium average for edible vegetation for this time period was 0.284 pCi/g.

Cesium-137

For Cs-137, pathways through plant foods are relatively unimportant as cesium is poorly absorbed by the plants from the soil, and it is relatively uniformly distributed throughout all portions of the plant and does not tend to concentrate in the edible portions. Grains however, do tend to have relatively high concentrations although fruits and root vegetables, which have a high water content, tend to have low concentrations of cesium (Kathren 1984). Cs-137 is a major radionuclide in spent nuclear fuel, high level radioactive waste resulting from the processing of

spent nuclear fuel, and radioactive wastes associated with the operation of nuclear reactors and fuel reprocessing plants. Radioactive cesium is present in soil around the world largely as a result of fallout from past atmospheric nuclear weapons tests. The concentration of Cs-137 in surface soil from fallout ranges from about 0.1 to 1 pCi/g, averaging less than 0.4 pCi/g. Cesium is generally one of the less mobile radioactive metals in the environment. It preferentially adheres quite well to soil, and the concentration associated with sandy soil particles is estimated to be 280 times higher than in interstitial water; concentration ratios are much higher in clay and loam soils. Thus, cesium is generally not a major contaminant in groundwater at DOE sites or other locations (ANL 2005).

For 2007, DOE-SR data indicates Cs-137 detections in greens samples at four locations, wheat at one location and cabbage at all five locations. The highest detection above the DOE-SR MDA was in a cabbage sample at 0.492 pCi/g. The lowest detection was at 0.0109 pCi/g in both a wheat sample and a greens sample from the NW quadrant sampling location. The Cs-137 average for DOE-SR samples around the perimeter of SRS is 0.036 (±0.028) pCi/g with a median of 0.028 pCi/g. None of the 41ESOP samples collected in 2007 had Cs-137 detects. All samples, both perimeter and background, between 2004 and 2007 (Section 3.3.2) were also less than the minimum detectable activity for Cs-137. Statistical comparisons between the two programs cannot be made at this time due to Cs-137 data from the ESOP program being lower than the detection limit.

Strontium 89/90

The food crop pathway for strontium is important largely because the downward movement of strontium in soils is relatively slow; even in soils with low clay and humus content, through which movement is fastest, most of the strontium will remain in the upper few centimeters several years after deposition. Low calcium content of the soil furthers strontium uptake by plants, as does low pH. Treatment of soil with lime to increase pH has been suggested as a means of reducing plant uptake of radiostrontiums from soil (Kathren 1984).

Although ESOP and DOE-SR analyzes for total strontium, NL states that r-90 is present in surface soil around the world as a result of fallout from past atmospheric nuclear weapons tests. According to ANL, in 2005, Sr-90 levels in surface soil typically ranged from 0.01 to 1 pCi/g reflecting various rainfall and wind patterns, elevation, and terrain; most levels fall between 0.05 and 0.5 pCi/g, with 0.1 pCi/g as a general average. Strontium preferentially adheres to soil particles, and the amount in sandy soil is typically about 15 times higher than in interstitial water; concentrations ratios are typically higher (110) in clay soil (ANL 2007).

Strontium-89/90 was detected in six of the 2007 ESOP samples. One collard sample from the Salley quad and one mustard sample from the Springfield , both perimeter locations, had the highest Sr-89/90 detection of 0.076 pCi/g. The highest Sr-89/90 background sample, from the Saluda quad, had a detection of 1.50 pCi/g. The average Sr-89/90 for all edible vegetation samples with detections, within the 50-mile perimeter of the SRS, was 0.067 (± 0.015) pCi/g with a median of 0.076 pCi/g. For all edible background samples, those samples farther than the 50-mile perimeter, the Sr-89/90 average was 0.507 (± 0.860) pCi/g with a median of 0.013 pCi/g. The DOE-SR data indicates that there were three detections of Sr-89/90 above the DOE-SR MDC in edible vegetation samples: two in greens, and one in cabbage. The highest detection was

in a greens sample with a detect of 0.256 pCi/g. The lowest detection of 0.238 pCi/g was in a cabbage sample. The perimeter Sr-89/90 average for DOE-SR samples with detects was 0.178 (±0.133) pCi/g with a median of 0.254 pCi/g. Since the DOE-SR does not collect data greater than 50 miles from the perimeter of the SRS, ESOP background statistical data could not be compared. Between 2004 and 2007, the Sr-89/90 average was 0.059 (±0.020) pCi/g with a median of 0.063 pCi/g for all edible vegetation collected around the perimeter of SRS. For the same time period, there was only one detect of Sr-89/90 in the background locations sampled.

Between the years of 2004-2007 (Section 3.3.2, Table 1), the following can be surmised:

- Tritium was detected in all samples each year for both perimeter and background samples. The highest detect was from a watermelon sample located near Clear Pond at 0.423 pCi/g in 2006 as compared to the 2007 sample from Steedman at 0.271 pCi/g in 2007;
- Cs-137 was not detected in any of the samples;
- A Sr-89/90 detect of 0.076 pCi/g was in one collard sample from Salley.

ESOP collected corn and soybean samples in 2005 and 2007. The highest detection of a soybean sample was from a perimeter location in Gifford, 0.329 pCi/g of tritium and 0.051 of Sr-89/90 in 2007. The lowest soybean detection was also from a perimeter location in Crocketville with a tritium detection of 0.191pCi/g in 2007. The highest detection of a corn sample was from a background location in Gilbert, 0.403 pCi/g of tritium in 2007. The lowest detection of a corn sample was from a perimeter location in Midway, 0.252 pCi/g of tritium in 2006.

Naturally Occurring Isotopes

Lead (Pb-212, Pb-214), Beryllium-7 (Be-7), and Potassium-40 (K-40) are all naturally occurring radioactive isotopes in the environment. Pb-212/Pb-214 and Be-7 were detected in several samples (EVE40-01, EVE59A, and EVE51) ESOP collected this year (Section 3.3.3). Discussion on these isotopes is brief as they do not occur on a routine basis. K-40 is discussed briefly as it is detected in all edible vegetation samples (Section 3.3.3).

Lead occurs everywhere in the environment with concentrations in U.S. soil typically ranging from less than 10 to 30 milligrams of lead per kilogram of soil (mg/kg). Concentrations in sandy soil particles are estimated to be 270 times higher than in the water in pore spaces; binding even more tightly to clay and loam soils, with concentration ratios of about 500 to more than 16,000. Reported concentrations of lead in various foods range from 0.002 to 0.65 mg/kg with higher levels generally found in vegetables. The typical concentration of lead in plants to that in the soil on which they grow is estimated at roughly four percent (ANL 2007)

Beryllium, like potassium, occurs naturally in the earth's crust. The concentration generally ranges from 1 to 15 mg/kg, which is the same as parts per million (ppm). The average concentration of naturally occurring beryllium in U.S. soils is 0.6 ppm and levels typically range from 0. to 40ppm. Concentrations in sandy soil are estimated to be up to 250 times higher than in the water in the pore space between the soil particles, with much higher concentration ratios in loam and clay soils. Being naturally present in various food types, beryllium has a median concentration of 22.5 micrograms/kilograms reported across 38 different food types, ranging from less than 0.1 microgram/kilogram to 2,200 micrograms/kilogram in kidney beans (for

example). The major source of environmental releases from human activities is combustion of coal and fuel oil (ANL 2007).
Potassium occurs in the earth's crust, oceans and all organic material. Potassium binds preferentially to soil, with the concentration associated with sandy soil particles estimated to be 15 times higher than in the pore spaces between soil particles; it binds more tightly to loam and clay soil, so those concentration ratios are higher (above 50). Together with nitrogen and phosphorous, potassium is a major soil fertilizer, so levels of potassium-40 (K-40) in soils are strongly influenced by fertilizer use; it is estimated that about 3,000 Ci of K-40 are added annually to U.S. soils. Potassium behaves in the environment the same as other potassium isotopes, being assimilated into the tissues of all plants and animals through normal biological processes. For example, milk contains about 2000 pCi/L of natural potassium-40 (ANL 2007).

Potassium-40 was detected in all food samples collected around the perimeter of the SRS with concentrations ranging from a minimum detection of 0.986 pCi/g (watermelon) to a maximum detection of 8.230 pCi/g (soybeans). All background samples collected had detections of K-40 except one. Background concentrations ranged from 1.143 pCi/g (pears) from the Lake Murray quad to 6.017 pCi/g (turnips) from the Hartwell Dam quad located in Anderson County, SC.

CONCLUSIONS AND RECOMMENDATIONS

ESOP and DOE-SR have similar sampling schemes. The DOE-SR has annual participants from 0-10 miles from the perimeter of the SRS and has a 25 mile control station. The ESOP has begun to establish annual contributors around the perimeter of the SRS for similar food products for data comparisons; re-established the plum stations to create a body of data for a fruit around the perimeter of SRS; and will continue to sample using the quad locations of < 50 miles from SRS and > 50 from SRS for statistical testing calculations.

The ESOP narrowed the list of food products in 2007 to more closely match what the DOE-SR collects for better data comparisons. However, the only food product for 2007 that could be compared between the two programs for tritium was greens because DOE-SR data indicated that no tritium was detected in fruit samples. Since the DOE-SR does not collect data greater than 50 miles from the perimeter of the SRS, ESOP background statistical data could not be compared. Statistical comparisons for Cs-137 data between the two programs cannot be made at this time due to data from the ESOP program being lower than the detection limit.
In 2008, ESOP plans to continue the quad sampling to get an overall picture of South Carolina, conduct some uranium and plutonium analyses for comparison to DOE-SR; as well as increase the number of perimeter annual contributors, and continue the annual perimeter plum sampling.

Back to Table of Contents

3.3.2 Tables And Figures

Radiological Monitoring of Edible Vegetation

Table 1.
2004-2007 All Edible Vegetation
ESOP: Perimeter Detects

Sample Location	Quad Location	Sample Date	Type	H-3(pCi/g)	Cs-137	Sr-89/90
AKN202	Aiken	10/22/04	Pears	0.266	<MDA	
ALN-201	Allendale	06/03/04	Plums	0.273	<MDA	
ALN-203	Allendale	06/03/04	Plums	0.284	<MDA	
EVE2-001	Barnwell	10/07/05	Soybeans	0.257	<MDA	
EVE21-001	Clear Pond	06/23/06	Blackberries	0.371	<MDA	
EVE21-002	Clear Pond	06/23/06	Watermelon	0.423	<MDA	
EVE51	Crocketville	10/12/07	Soybeans	0.191	<MDA	
ESTE1-001	Furman	06/17/05	Turnips	0.201	<MDA	
ESTE1-002	Furman	06/17/05	Turnips	0.212	<MDA	
ESTE1-003	Furman	06/17/05	Squash	0.201	<MDA	
EVE45	Gifford	10/12/07	Soybeans	0.329	<MDA	0.051
EVE30-001	Graniteville	11/17/06	Collards	0.271	<MDA	
EVE22	Grays	08/04/06	Okra	0.332	<MDA	
EVE24-002	Long Branch	8/16/06	Apples	0.192	<MDA	
EVE32	Martinez	10/26/06	Mustards	0.199	<MDA	0.035
EVE18-001	Midway	06/23/06	Corn	0.252	<MDA	
EVE18-002	Midway	06/23/06	Squash	0.246	<MDA	
EVE3X	New Ellenton, SE	10/12/05	Grapes	0.195	<MDA	
EVE28	Salley	01/30/07	Collards	0.240	<MDA	0.076
SNL-203	Snelling	06/03/04	Plums	0.803	<MDA	
EVE36	Springfield	02/06/07	Mustards	0.216	<MDA	0.076
EVE35-02	Steedman	08/10/07	Peaches	0.410	<MDA	
EVE35-01	Steedman	08/10/07	Watermelon	0.271	<MDA	
WIL-204	Williston	8/29/04	Passion Fruit	0.189	<MDA	
WIN-201	Windsor	10/22/04	Persimmons	0.224	<MDA	
			Perimeter Average:	0.282		0.059
			Median	0.252		0.063
			StdDeviation	0.128		0.020

Total Perimeter Samples with Detects: 25
Total Perimeter Samples Collected 04-07: 83

Notes: 1. Shaded area means not analyzed.
2. Highlighted data reflects 2007 data for comparison.

Tables and Figures
Radiological Monitoring of Edible Vegetation

Table 2.
2004-2007 Tritium in Plums
ESOP Annual SRS Perimeter Collections

Sample Location	Quad Location	Sample Date	H-3(pCi/g)	Cs-137
EVAKN-01	Aiken	5/16/2007	<LLD	<MDA
ALN-201	Allendale	06/03/04	0.273	<MDA
ALN-203	Allendale	06/03/04	0.284	<MDA
EVALN-01	Allendale	5/16/2007	<LLD	<MDA
EVBWL-01	Barnwell	5/16/2007	<LLD	<MDA
EVJAK-01	Jackson	5/16/2007	<LLD	<MDA
EVE19	Mechanics Hill	05/11/06	<188	<MDA
EVNEW-01	New Ellenton, SE	05/23/07	<LLD	<MDA
EVE11-02	North	05/25/06	<188	<MDA
EVE43	Olar	05/24/07	<LLD	<MDA
EVSNL-01	Snelling	5/16/2007	<LLD	<MDA
SNL-201	Snelling	06/03/04	<186	<MDA
SNL-203	Snelling	06/03/04	0.803	<MDA
		Average	0.453	
		Median	0.284	
		Std Dev	0.303	

Total Samples with Detects: 3
Total Samples Collected 04-07: 13

Back to Table of Contents

3.3.3 Data

Radiological Monitoring of Edible Vegetation

2007 Environmental Samples 308

2007 Background Samples 311

Notes:

1 Tritium values are reported in pCi/g of water converted from pCi/L.
2 Shaded areas denote no analysis.
3 LLD denotes Lower Limit of Detection
4 MDA denote Minimum Detectable Activity

Back to List of Data Tables

Radiological Monitoring of Edible Vegetation

Environmental Samples

Sample Location:	EVE28	EVE36	EVE40-01	EVE40-02	EVE47
Sample Date:	01/30/07	2/6/07	02/06/07	02/06/07	03/26/07
Type	Collards	Mustard	Turnips	Collards	Pokeberry
Location:	Salley	Springfield	Barnwell	Barnwell	Barr Lake
Radionuclides					
Tritium (pCi/g	0.240	0.216	<LLD	<LLD	<LLD
+/-2 sigma	89	98			
LLD	<0.185	<0.213	<0.213	<0.213	<0.213
K-40 (pCi/g)	2.894	4.504	6.691	4.061	6.079
+/-2 sigma	0.665	0.866	0.921	0.687	0.822
MDA	0.317	0.331	0.308	0.269	0.305
Cs-137 (pCi/g)	<MDA	<MDA	<MDA	<MDA	<MDA
+/-2 sigma					
MDA	0.039	0.040	0.040	0.034	0.036
Sr-89/90 (pCi/g)	0.076	0.076			
+/-2 sigma	0.011	0.009			
MDC	0.010	0.007			
Be-7 (pCi/g)			1.632		
+/-2 sigma			0.748		
MDC			0.631		

Sample Location:	EVAKN-01	EVBWL-01	EVSNL-01	EVALN-01	EVJAK-01
Sample Date:	5/16/2007	5/16/2007	5/16/2007	5/16/2007	5/16/2007
Type	Plums	Plums	Plums	Plums	Plums
Location	Aiken	Barnwell	Snelling	Allendale	Jackson
Radionuclides					
Tritium (pCi/g	<LLD	<LLD	<LLD	<LLD	<LLD
+/-2 sigma					
LLD	<0.212	<0.212	<0.212	<0.212	<0.212
K-40 (pCi/g)	2.304	2.346	2.211	1.847	2.290
+/-2 sigma	0.372	0.399	0.365	0.338	0.417
MDA	0.153	0.172	0.144	0.164	1.967
Cs-137 (pCi/g)	<MDA	<MDA	<MDA	<MDA	<MDA
+/-2 sigma					
MDA	0.020	0.021	0.022	0.019	0.022
Sr-89/90 (pCi/g)					
+/-2 sigma					
MDC					

Radiological Monitoring of Edible Vegetation

Environmental Samples

Sample Location:	EVNEW-01	EVE43	EVE59A	EVE43A	EVE40A
Sample Date:	05/23/07	05/24/07	6/18/2007	06/27/07	06/27/07
Type	Plums	Plums	Corn	Corn	Collards
Location:	New Ellenton	Olar	Williston	Olar	Blackville
Radionuclides					
Tritium (pCi/g	<LLD	<LLD	<LLD	<LLD	<LLD
+/-2 sigma					
LLD	<0.212	<0.212	<0.212	<0.212	<0.212
K-40 (pCi/g)	2.395	2.29	3.044	2.550	3.155
+/-2 sigma	0.524	0.403	0.464	0.430	0.522
MDA	0.193	0.171	0.174	0.132	0.199
Cs-137 (pCi/g)	<MDA	<MDA	<MDA	<MDA	<MDA
+/-2 sigma					
MDA	0.020	0.020	0.025	0.024	0.026
Pb-214 (pCi/g)			0.093		
+/-2 sigma			0.039		
MDA			0.049		
Sr-89/90 (pCi/g)					
+/-2 sigma					
MDC					

Sample Location:	EVE33-02	EVE44	EVE49A-01	EVE49A-02	EVE33-01	EVE41-01
Sample Date:	07/12/07	07/12/07	07/12/07	07/12/07	07/12/07	07/17/07
Type	Watermelon	Corn	Corn	Watermelon	Corn	Corn
Location:	Snelling	Girard	Millett	Millett	Snelling	Windsor
Radionuclides						
Tritium (pCi/g	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
+/-2 sigma						
LLD	<0.213	<0.213	<0.213	<0.213	<0.213	<0.213
K-40 (pCi/g)	1.365	2.492	2.619	1.557	2.383	2.378
+/-2 sigma	0.288	0.467	0.461	0.337	0.392	0.417
MDA	0.125	0.177	0.237	0.142	0.153	0.163
Cs-137 (pCi/g)	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
+/-2 sigma						
MDA	0.020	0.024	0.023	0.017	0.023	0.025
Pb-212 (pCi/g)						
+/-2 sigma						
MDA						
Pb-214 (pCi/g)						
+/-2 sigma						
MDA						
Sr-89/90 (pCi/g)						
+/-2 sigma						
MDC						

Radiological Monitoring of Edible Vegetation

Environmental Samples

Sample Location:	EVE41-02	EVE46	EVE37	EVE34	EVE35-01	EVE35-02
Sample Date:	07/17/07	07/17/07	7/17/07	07/19/07	08/10/07	08/10/07
Type	Watermelon	Corn	Corn	Watermelon	Watermelon	Peaches
Radionuclides	Windsor	Cordova	Sycamore	Gilbert	Steedman	Steedman
Tritium (pCi/g	<LLD	<LLD	<LLD	<LLD	0.271	0.410
+/-2 sigma					90	95
LLD	<0.213	<0.213	<0.213	<0.213	<0.185	<0.185
K-40 (pCi/g)	1.390	2.135	2.428	1.239	1.329	2.156
+/-2 sigma	0.326	0.450	0.462	0.291	0.304	0.335
MDA	0.132	0.217	0.155	0.133	0.121	0.126
Cs-137 (pCi/g)	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
+/-2 sigma						
MDA	0.019	0.027	0.024	0.016	0.019	0.018
Sr-89/90 (pCi/g)						
+/-2 sigma						
MDC						
Pb-212 (pCi/g)						
+/-2 sigma						
MDA						
Pb-214 (pCi/g)						
+/-2 sigma						
MDA						

Radiological Monitoring of Edible Vegetation

Background Samples

Sample Location:	EVB16	EVB17	EVB32-01	EVB32-02	EVB41-01	EVB41-02
Sample Date:	02/15/07	02/15/07	03/30/07	03/30/07	07/19/07	07/19/07
Type	Mustard	Turnips	Kale	Collards	Watermelon	Corn
Location:	Westminster	Hartwell Dam	Saluda South	Saluda South	Gilbert	Gilbert
Radionuclides						
Tritium (pCi/g	<LLD	<LLD	<LLD	<LLD	0.204	0.403
+/-2 sigma					87	95
LLD	0.213	0.213	0.213	0.213	0.185	0.185
K-40 (pCi/g)	5.554	6.017	4.351	2.269	1.901	2.658
+/-2 sigma	0.914	1.130	0.736	0.704	0.352	0.454
MDA	0.305	0.481	0.298	0.319	0.156	0.175
Cs-137 (pCi/g)	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
+/-2 sigma						
MDA	0.040	0.052	0.036	0.040	0.017	0.025
Sr-89/90 (pCi/g)				1.50		
+/-2 sigma				0.117		
MDC				0.013		
Pb-212 (pCi/g)						
+/-2 sigma						
MDA						
Pb-214 (pCi/g)						
+/-2 sigma						
MDA						

Radiological Monitoring of Edible Vegetation

Background Samples

Sample Location:	EVBLAN	EVB14	EVB19	EVB12	EVB8
Sample Date:	8/21/2008	08/31/07	10/01/07	10/12/07	12/13/07
Type:	Peaches	Pears	Soybeans	Soybeans	Collards
Location:	Landrum	Lake Murray	Salters	Summerton	Bingham
Radionuclides					
Tritium (pCi/g	0.315	0.280	<LLD	0.302	<LLD
+/-2 sigma	91	90		92	
LLD	0.185	0.185	0.213	0.185	0.185
K-40 (pCi/g)	2.360	1.143	4.864	4.612	
+/-2 sigma	0.314	0.205	0.697	0.640	
MDA	0.134	0.080	0.334	0.230	
Cs-137 (pCi/g)	<MDA	<MDA	<MDA	<MDA	
+/-2 sigma					
MDA	0.013	0.011	0.040	0.028	
Sr-89/90 (pCi/g)			0.009	0.013	
+/-2 sigma			0.002	0.002	
MDC			0.004	0.003	
Pb-212 (pCi/g)			0.053		
+/-2 sigma			0.020		
MDA			0.022		
Pb-214 (pCi/g)	0.054		0.152		
+/-2 sigma	0.023		0.050		
MDA	0.027		0.078		

Back to List of Data Tables

3.3.4 Summary Statistics

Radiological Monitoring of Edible Vegetation

Tritium, Cesium-137, and Strontium 89/90

2007 ESOP Environmental and Background Summaries 314

2007 DOE-SR Data 315

Notes:

1. Perimeter results include both random and non-random SRS perimeter locations (<50 miles from the perimeter of SRS).
2. Shaded areas denote no analysis.
3. n = Total number of samples.

Back to List of Summary Statistics

Summary Statistics

Radiological Monitoring of Edible Vegetation

2007 ESOP ENVIRONMENTAL DATA (Detects Only)
H-3, Cs-137, Sr-89/90 Greens, Watermelon, Peaches, Soybeans

Sample Location:	Sample Collected:	Sample Date:	Tritium (pCi/g)	Cs-137 (pCi/g)	Sr-89/90 (pCi/g)
EVE28	Collards	01/30/07	0.240	<MDA	0.076
EVE36	Mustard	2/6/07	0.216	<MDA	0.076
EVE35-01	Watermelon	08/10/07	0.271	<MDA	
EVE35-02	Peaches	08/10/07	0.410	<MDA	
EVE51	Soybeans	10/12/07	0.191	<MDA	
EVE45	Soybeans	10/12/07	0.329	<MDA	0.051
		Average	0.276		0.067
		Median	0.256		0.076
		Std Deviation	0.081		0.015
		n=	6		3

2007 ESOP Background Data (Detects Only)
H-3,Cs-137,Sr-89/90 Greens, Watermelon, Corn, Pears, Soybeans

Sample Location:	Sample Collected:	Sample Date:	Tritium (pCi/g)	Cs-137 (pCi/g)	Sr-89/90 (pCi/g)
EVB32-02	Collards	03/30/07	<LLD	<MDA	1.50
EVB41-01	Watermelon	07/19/07	0.204	<MDA	
EVB41-02	Corn	07/19/07	0.403	<MDA	
EVBLAN	Peaches	8/21/08	0.315	<MDA	
EVB14	Pears	08/31/07	0.280	<MDA	
EVB19	Soybeans	10/01/07	<LLD	<MDA	0.009
EVB12	Soybeans	10/12/07	0.302	<MDA	0.013
		Average	0.301		0.507
		Median	0.302		0.013
		Std Deviation	0.072		0.860
		n=	5		3

Summary Statistics

Radiological Monitoring of Edible Vegetation

2007 DOE-SR Data
Cs-137: Greens, Wheat, Cabbage

Location	Type	Nuclide	Date Collected	Result
NE Quadrant 0-10 Miles	Greens	Cs-137	3-Jan-07	0.0231
NW Quadrant 0-10 Miles	Greens	Cs-137	11-Jan-07	0.0109
SE Quadrant 0-10 Miles	Greens	Cs-137	3-Jan-07	0.0408
SW Quadrant 0-10 Miles	Greens	Cs-137	23-Jan-07	0.1170
NW Quadrant 0-10 Miles	Wheat	Cs-137	6-Jun-07	0.0109
NE Quadrant 0-10 Miles	Cabbage	Cs-137	25-Jan-07	0.0269
NW Quadrant 0-10 Miles	Cabbage	Cs-137	11-Jan-07	0.0300
SE Quadrant 0-10 Miles	Cabbage	Cs-137	4-Jan-07	0.0228
SE Quadrant 25 Miles	Cabbage	Cs-137	4-Jan-07	0.0492
SW Quadrant 0-10 Miles	Cabbage	Cs-137	13-Jan-07	0.0289
			Average	0.036
			Median	0.028
			Standard Deviation	0.028
			n=	15

Sr-89/90: Greens, Wheat, Cabbage

SE Quadrant 0-10 Miles	Greens	Sr-89/90	3-Jan-07	0.256
SE Quadrant 25 Miles	Greens	Sr-89/90	23-Jan-07	0.254
SE Quadrant 25 Miles	Cabbage	Sr-89/90	4-Jan-07	0.0238
			Average	0.178
			Median	0.254
			Standard Deviation	0.133
			n=	15

Back to List of Summary Statistics

3.4 Radiological Monitoring of Dairy Milk

3.4.1 Summary

Operations at the Savannah River Site (SRS) have resulted in the potential for radiological constituents to be released to the surrounding environment. Milk from dairies around the SRS is routinely analyzed for levels of radioactivity that could impact human health. This project provides radiological dairy milk monitoring of selected cow dairies within a 50-mile radius of the SRS in South Carolina. This project also provides analytical data for comparison to published Department of Energy-Savannah River (DOE-SR) data.

Consumption of milk products containing radioactive materials can be an important human exposure pathway to radioactivity. When an atmospheric release occurs, radionuclides can be deposited on pastures and ingested by grazing dairy cows. The cows would then release a portion of the radioactivity into the milk that is consumed by humans (CDC 2001). The milk pathway is especially important in the case of infants and children. They are more likely to drink large quantities of milk, and are actively developing bones and teeth. Radioactive strontium is a calcium analogue and may show a tendency to accumulate in these structures (Kathren 1984).

During 2007, DOE-SR collected samples from four dairy locations, two of which are located in South Carolina (WSRC 2008a). The South Carolina Department of Health and Environmental Control (SCDHEC) Environmental Surveillance and Oversight Program (ESOP) collected milk at seven cow dairy locations within the state (five perimeter and two background) to provide an independent source of data on radionuclide concentrations of concern in milk (Map 10, Section 3.4.2).

SCDHEC personnel collected samples on a quarterly basis in 2007. Cow milk samples from each quarter were analyzed for tritium, total strontium-89/90, and select gamma-emitting radionuclides, specifically iodine-131, cesium-137, and cobalt-60.

SCDHEC did not detect any man-made gamma-emitting radionuclides or tritium in any of the unpasteurized cow milk collected during 2007. Tritium was not detected in any SCDHEC collected samples. Total strontium-89/90 was detected in both background and perimeter locations tested in 2007. The source of the strontium is likely due to historical atmospheric nuclear weapons testing. Strontium has slow long-term fallout properties and, a long half-life (Larson 1958). One total strontium-89/90 detection, in May from Norway, South Carolina, (SC), exceeded the United States Environmental Protection Agency (USEPA) drinking water Maximum Contaminant Level (MCL) of 8 picocuries per Liter (pCi/L) for strontium-90 (Sr-90) (USEPA 2002c). However, this detection is likely a lab error as the total strontium-89/90 values returned to historical values in other quarters sampling with the only exception being the May sampling event.

DOE-SR did not detect gamma-emitting radionuclides of concern (cesium-137 or cobalt-60), or Sr-90 in 2007. Tritium was detected in three DOE-SR samples, one in a sample collected in Denmark, South Carolina during July that was just above the DOE-SR detection limit of 416 pCi/L (WSRC 2008a).

During 2007, concentrations of radionuclides of concern in milk did not deviate from historically expected levels, as measured by DOE-SR and SCDHEC. SCDHEC will continue to monitor dairies for radionuclides that have the potential to impact human health.

RESULTS AND DISCUSSION

Tritium

Historically tritium has been the main product of operations at SRS; it was produced as a nuclear weapon enhancement component. The majority of tritium released was in the production reactors and separation areas (CDC 2001).

No SCDHEC milk sample collected during 2007 exhibited tritium activity above the Lower Limit of Detection (LLD) of 223 pCi/L. In 2006 there were three detections in SCDHEC milk samples (SCDHEC 2007e). Figure 2 of Section 3.4.3 illustrates average tritium detections for the nine years SCDHEC has sampled milk. All tritium detections have been below the USEPA drinking water MCL of 20,000 pCi/L for tritium. DOE-SR detected tritium in two Georgia samples and one from Denmark, SC with DOE-SR tritium detections averaging 557.0 (± 41.6) pCi/L (WSRC 2008a). DOE-SR uses all data to calculate means including tritium data below the Minimum Detectable Concentration (MDC). SCDHEC does not use numbers less than the corresponding Lower Limit of Detection (LLD) because they cannot be accurately quantified. The tritium results for all milk samples collected by SCDHEC are given in Section 3.4.4. No summary statistics were calculated for tritium as all results were below the LLD.

Gamma-emitting Radionuclides

The gamma-emitting radionuclides iodine-131 (I-131), cesium-137 (Cs-137), and cobalt-60 (Co-60), are man-made radioactive elements that can impact public health and were all products of SRS activities. These radionuclides were produced by fission in reactor fuels. They were primarily released in surface streams in the 1960s, or into the atmosphere in the separation areas (CDC 2001; WSRC 1998).

SCDHEC tested for I-131, Cs-137, and Co-60 in all milk samples collected in 2007. All analytical results for these radionuclides were below the sample MDA. These results are consistent with 2006 results (SCDHEC 2007e). DOE-SR tested for Cs-137 and Co-60 with no detections in 2007 (WSRC 2008a). All analytical results for gamma-emitting radionuclides are located in Section 3.4.4. No summary statistics were calculated for these radionuclides as all results were below the MDA.

Total Strontium-89/90

Strontium is present around the world due to nuclear weapons testing in the 1950s and 1960s (CDC 2001). Since strontium has slow fallout from the atmosphere and a 29-year half-life, it is still present in the environment; however, concentrations are low and continue to decrease over time (USEPA 2002c; Larson 1958). SRS operations have also released strontium into the environment. Strontium was a product of fission in SRS reactors, and was subsequently released in the F and H separation areas (WSRC 1998).

Samples were collected quarterly in 2007 for total strontium analysis, Section 3.4.4. The range for these detections was 0.919 pCi/L to 22.7 pCi/L, with the minimum detection in a sample from Denmark, SC and the maximum detection in a sample from Norway, SC. The maximum total strontium detection of 22.7 pCi/L is likely a lab error, however, this sample could not be reprocessed. This location returned to expected concentrations in the next quarter's results. No other samples had detections close to 22.7 pCi/L; the maximum detection excluding this outlier was 1.11 pCi/L. All data summaries include this detection. Perimeter detections averaged 4.06 (± 8.22) pCi/L (Section 3.4.5). Background detections averaged 0.93 ± .006 pCi/L (Section 3.4.5). The average for all Sr-89/90 detections was 3.36 (± 7.25) pCi/L. This average is below the USEPA established MCL of 8 pCi/L for Sr-90 in drinking water (USEPA 2002). This average is an increase from 2006, when the strontium average was 1.772 (± 2.12) pCi/L (SCDHEC 2007e). Figure 2 Section 3.4.3 shows the trend for SCDHEC strontium detections for the last nine years. All strontium detections have been below the USEPA established MCL for Sr-90 since testing began in 1998. DOE-SR did not have any Sr-90 detections in 2007, although the DOE-SR MDC for Sr-90 was unusually high at 67 pCi/L (WSRC 2008a) whereas in 2005 and 2006 the MDC was 1.27 and 1.35 pCi/L respectively.

Statistical testing was limited to a comparison of averages of all environmental perimeter samples collected within 50 miles of the SRS perimeter, and all background samples, as shown in Section 3.4.5. Data collected for locations closer to SRS have higher strontium levels than background locations for averaged values.

CONCLUSIONS AND RECOMMENDATIONS

The DOE-SR uses all analytical results, including below MDC, to compute means. SCDHEC uses only detections to compute averages. Consequently, dairy milk analytical data comparisons between SCDHEC and DOE-SR were not conducted.

An evaluation of average concentrations by sampling location is included in Section 3.4.5. Data collected for locations closer to SRS have higher strontium than background locations for averaged values.

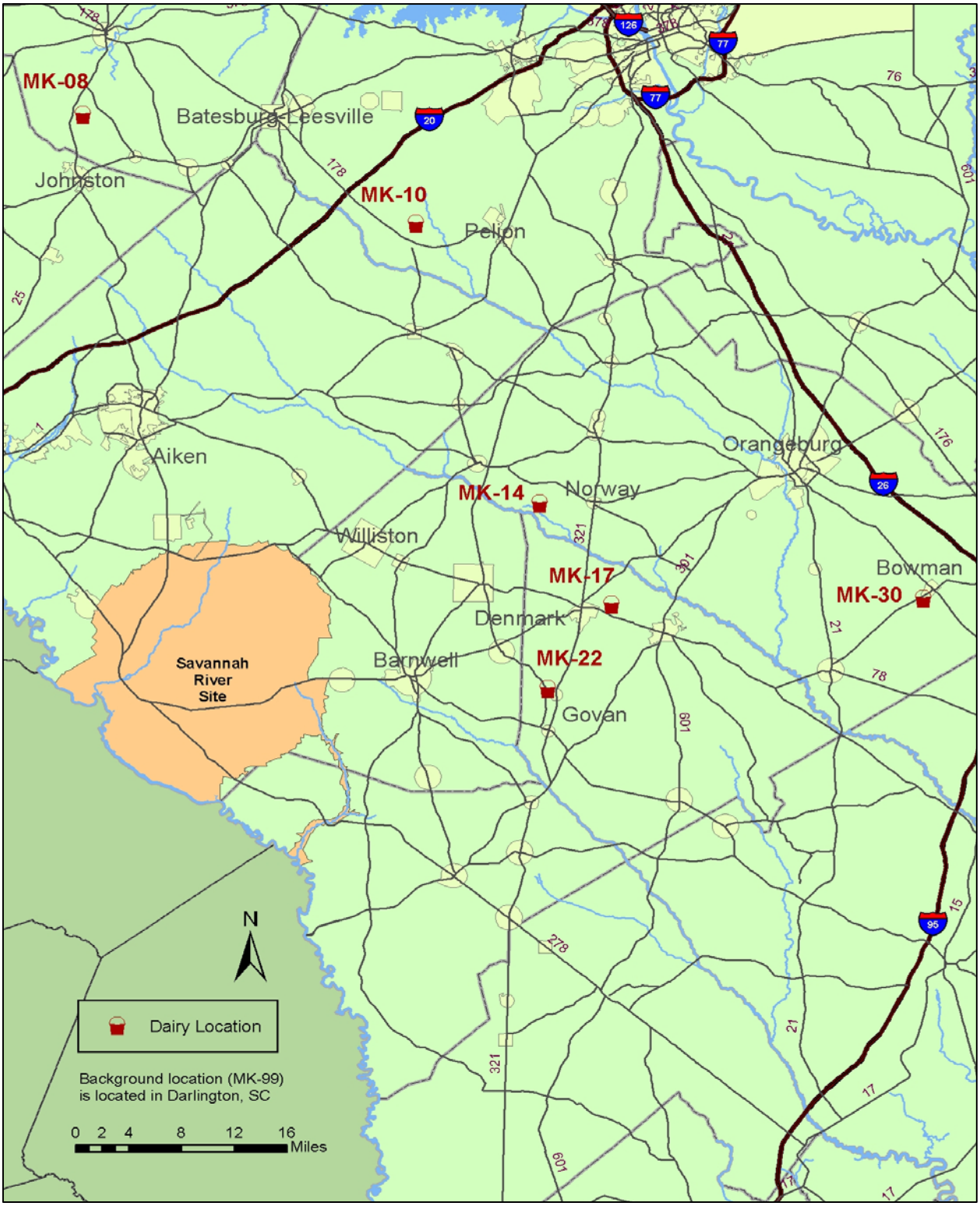
A large portion of the radiological activity observed in collected milk samples can be attributed to fallout from past nuclear testing. Also, radionuclides within soil and plants can potentially be redistributed as a result of farming practices and prescribed burns. SCDHEC will continue to monitor tritium, gamma-emitting radionuclides that can effect human health, and strontium in cow milk to ensure the safety of milk consumption by the public. Additional dairy sources will be added to the network if and when they become available.

Back to Table of Contents

3.4.2

Map 10. Radiological Monitoring of Dairy Milk Locations, 2007

Back to Maps

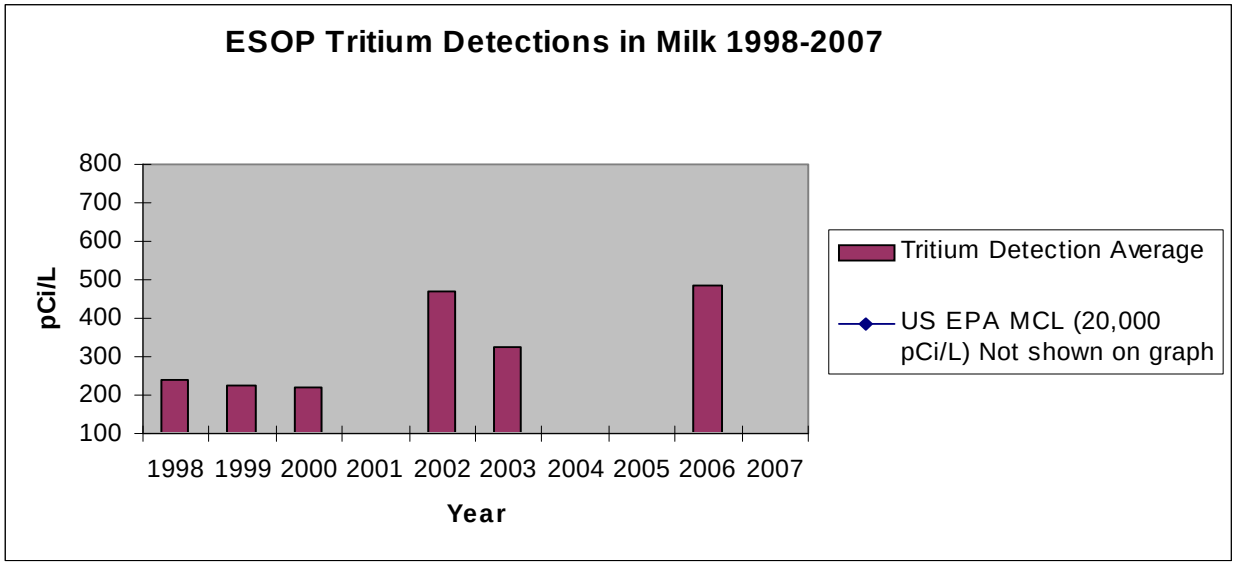


3.4.3 Tables and Figures
Radiological Monitoring of Dairy Milk

Table 1. 2007 SCDHEC and DOE-SR Dairy Milk Sampling Locations

2007 SCDHEC and DOE-SR Dairy Milk Sampling Locations	
SCDHEC Cow Dairy Locations	**DOE-SR Cow Dairy Locations**
Denmark, SC, MK-17	Denmark, SC
Norway, SC, MK-14	Girard, GA
Leesville, SC, MK-10	Waynesboro, GA
Johnston, SC, MK-8	North Augusta, SC
Govan, SC, MK-22	
Bowman, SC*, MK-30	
Darlington, SC*, MK-99	
*Background Locations	

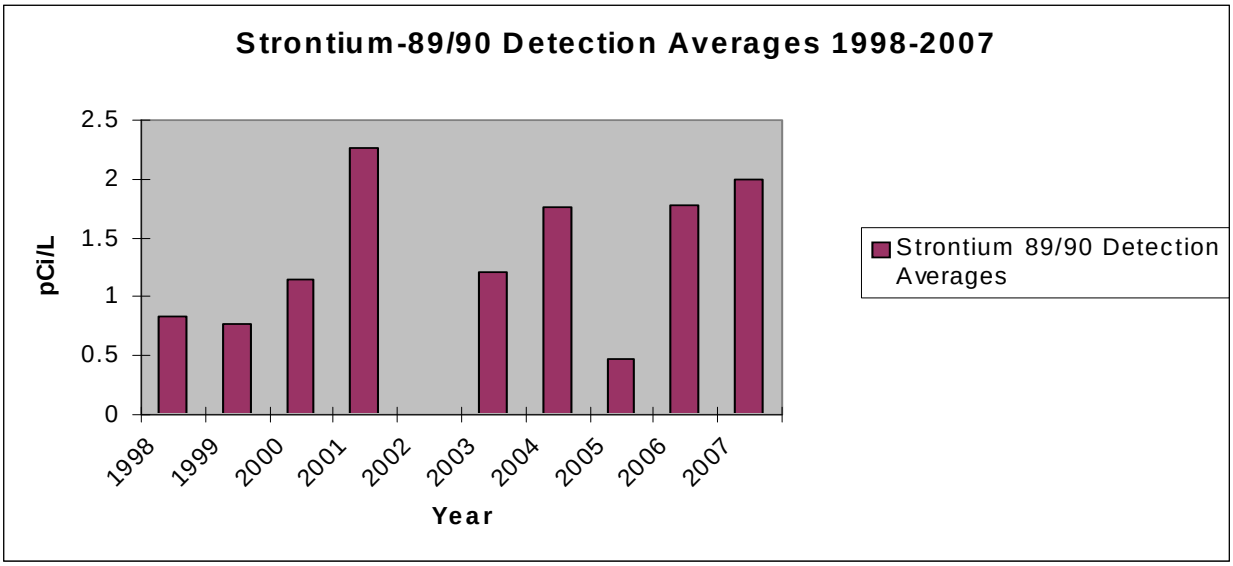
Figure 1. Average Tritium Detections in SCDHEC Milk 1998-2007



Tritium was not detected above LLD in 2001, 2004, 2005, and 2007

Tables and Figures
Radiological Monitoring of Dairy Milk

Figure 2. Strontium-89/90 Detection Averages 1998-2007



Strontium was not detected above MDA in 2002.

Back to Tables and Figures

3.4.4 Data

Radiological Monitoring of Dairy Milk

Tritium And Gamma-Emitting Milk Data 2007 323

Strontium Milk Data 2007 327

Notes:

1. LLD =Lower Limit of Detection
2. MDA = Minimum Detectable Activity
3. MDC = Minimum Detectable Concentration
4. 8 HLE = More than 8 half lives have elapsed
5. * Indicates a background sampling location

Back to List of Data Tables

Radiological Monitoring of Dairy Milk

Tritium and Gamma-emitting Milk Data 2007

Sample Location		MK-8 Johnston, SC			
Collection Date		3/27/2007	5/08/2007	08/23/07	12/17/07
Radionuclides:	Tritium (pCi/L)	<LLD	<LLD	<LLD	<LLD
	± 2 sigma				
	LLD	234	216	221	222
	Co-60 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	± 2 sigma				
	MDA	2.537E+00	2.040E+00	2.716E+00	2.737E+00
	I-131 (pCi/L)	<MDA	8 HLE	<MDA	8 HLE
	± 2 sigma				
	MDA	2.924E+01		6.006E+01	
	Cs-137 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	± 2 sigma				
	MDA	2.571E+00	2.209E+00	2.636E+00	2.608E+00

Sample Location		MK-10 Leesville, SC			
Collection Date		3/27/2007	5/11/2007	08/20/07	12/17/07
Radionuclides:	Tritium (pCi/L)	<LLD	<LLD	<LLD	<LLD
	± 2 sigma				
	LLD	233	215	222	222
	Co-60 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	± 2 sigma				
	MDA	2.271E+00	1.973E+00	2.742E+00	2.275E+00
	I-131 (pCi/L)	<MDA	8 HLE	<MDA	8 HLE
	± 2 sigma				
	MDA	2.255E+01		6.775E+01	
	Cs-137 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	± 2 sigma				
	MDA	2.697E+00	1.728E+00	2.700E+00	2.362E+00

Radiological Monitoring of Dairy Milk

Tritium and Gamma-emitting Milk Data 2007

Sample Location		MK-14 Norway, SC			
Collection Date		3/26/2007	5/09/2007	08/17/07	12/18/07
Radionuclides:	Tritium (pCi/L)	<LLD	<LLD	<LLD	<LLD
	± 2 sigma				
	LLD	235	216	222	221
	Co-60 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	± 2 sigma				
	MDA	2.405E+00	2.515E+00	2.862E+00	2.477E+00
	I-131 (pCi/L)	<MDA	8 HLE	<MDA	8 HLE
	± 2 sigma				
	MDA	2.100E+01		8.081E+01	
	Cs-137 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	± 2 sigma				
	MDA	2.695E+00	2.486E+00	2.700E+00	2.433E+00

Sample Location		MK-17 Denmark, SC			
Collection Date		3/26/2007	5/01/07	08/24/07	12/18/07
Radionuclides:	Tritium (pCi/L)	<LLD	<LLD	<LLD	<LLD
	± 2 sigma				
	LLD	233	217	221	222
	Co-60 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	± 2 sigma				
	MDA	2.308E+00	1.809E+00	3.093E+00	2.434E+00
	I-131 (pCi/L)	<MDA	8 HLE	<MDA	8 HLE
	± 2 sigma				
	MDA	2.074E+01		1.773E+02	
	Cs-137 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	± 2 sigma				
	MDA	2.698E+00	1.870E+00	3.239E+00	2.505E+00

Radiological Monitoring of Dairy Milk

Tritium and Gamma-emitting Milk Data 2007

Sample Location		MK-22 Govan, SC			
Collection Date		3/29/2007	5/09/2007	08/24/07	12/18/07
Radionuclides:	Tritium (pCi/L)	<LLD	<LLD	<LLD	<LLD
	± 2 sigma				
	LLD	233	216	221	222
	Co-60 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	± 2 sigma				
	MDA	2.240E+00	1.995E+00	3.004E+00	2.379E+00
	I-131 (pCi/L)	<MDA	8 HLE	<MDA	8 HLE
	± 2 sigma				
	MDA	2.844E+01		1.309E+03	
	Cs-137 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	± 2 sigma				
	MDA	2.698E+00	1.803E+00	2.697E+00	2.488E+00

Sample Location		MK-30 Bowman, SC*			
Collection Date		3/28/2007	5/01/2007	08/17/07	12/19/07
Radionuclides:	Tritium (pCi/L)	<LLD	<LLD	<LLD	<LLD
	± 2 sigma				
	LLD	233	217	222	222
	Co-60 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	+/- 2 SD				
	MDA	2.372E+00	2.290E+00	2.753+00	2.450E+00
	I-131 (pCi/L)	<MDA	8 HLE	<MDA	8 HLE
	± 2 sigma				
	MDA	2.759E+01		8.119E+01	
	Cs-137 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	± 2 sigma				
	MDA	2.697E+00	2.131E+00	2.674+00	2.617E+00

Radiological Monitoring of Dairy Milk

Tritium and Gamma-emitting Milk Data 2007

Sample Location		MK-99 Darlington, SC*			
Collection Date		3/28/2007	5/07/2007	08/21/07	12/19/07
Radionuclides:	Tritium (pCi/L)	<LLD	<LLD	<LLD	<LLD
	± 2 sigma				
	LLD	233	216	207	222
	Co-60 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	± 2 sigma				
	MDA	2.359E+00	1.953E+00	2.689E+00	2.651E+00
	I-131 (pCi/L)	<MDA	8 HLE	<MDA	8 HLE
	± 2 sigma				
	MDA	2.709E+01		6.377E+01	
	Cs-137 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	± 2 sigma				
	MDA	2.696E+00	1.965E+00	2.700E+00	2.342E+00

Radiological Monitoring of Dairy Milk

Strontium Data for Milk Samples Collected in 2007
Units are in picocuries per Liter (pCi/L)

Sample Location	MK-8 Johnston, SC			
Collection Date	3/27/07	5/08/07	8/23/07	12/17/07
Sr - 89/90	<MDC	<MDC	0.972	<MDC
± 2 sigma			0.472	
MDC	1.01	0.916	0.800	1.10

Sample Location	MK-10 Leesville, SC			
Collection Date	3/27/07	5/11/07	8/20/07	12/17/07
Sr - 89/90	<MDC	<MDC	0.754	<MDC
± 2 sigma			0.368	
MDC	1.21	0.783	0.620	1.09

Sample Location	MK-14 Norway, SC			
Collection Date	3/26/07	5/09/07	8/17/07	12/18/07
Sr - 89/90	1.01	22.7	1.11	0.928
± 2 sigma	0.560	2.11	0.430	0.463
MDC	0.624	1.06	0.707	0.841

Sample Location	MK-17 Denmark, SC			
Collection Date	3/26/07	5/01/07	8/24/07	12/18/07
Sr - 89/90	<MDC	<MDC	0.919	<MDC
± 2 sigma			0.384	
MDC	0.844	0.895	0.636	1.20

Sample Location	MK-22 Govan, SC			
Collection Date	3/29/07	5/09/07	8/24/07	12/18/07
Sr - 89/90	<MDC	<MDC	<MDC	<MDC
± 2 sigma				
MDC	0.966	1.08	1.04	1.20

Sample Location	MK-30 Bowman, SC*			
Collection Date	3/28/07	05/01/07	8/17/07	12/19/07
Sr - 89/90	<MDC	0.929	0.938	<MDC
± 2 sigma		0.590	0.448	
MDC	0.975	0.663	0.755	1.230

Radiological Monitoring of Dairy Milk

Strontium Data for Milk Samples Collected in 2007
Units are in picocuries per Liter (pCi/L)

Sample Location	MK-99 Darlington, SC*			
Collection Date	3/28/07	5/07/07	8/21/07	12/19/07
Sr - 89/90	<MDC	<MDC	<MDC	<MDC
± 2 sigma				
MDC	1.48	0.892	0.668	1.34

Back to List of Data Tables

3.4.5 Summary Statistics

Radiological Monitoring of Dairy Milk

Strontium Summary Statistics For Perimeter Milk Sample Detections.....330

Strontium Summary Statistics For Background Milk Sample Detections 330

Strontium Summary Statistics For All Milk Sample Detections.....330

Strontium Summary Statistics Comparison of Perimeter and Background Locations.....331

Notes:

1. N - Number of sampling locations
2. Avg. - Average
3. St. Dev. - Standard Deviation
4. Min. - Minimum
5. Max. - Maximum
6. MDC - Minimum Detectable Concentration
7. Statistics calculated for detections only
8. Non-detect denotes <MDC

Back to List of Summary Statistics

Summary Statistics

Radiological Monitoring of Dairy Milk

Strontium Summary Statistics for Perimeter Milk Sample Detections
Units are in picocuries per Liter (pCi/L)

Radionuclide:		Total Strontium-89/90					
Statistical Analysis:		**N**	**Avg.**	**St. Dev.**	**Median**	**Min**	**Max**
Perimeter System Number:	**MK-8**	1	0.972	0	0.972	0.972	0.972
	MK-10	1	0.754	0	0.754	0.754	0.754
	MK-14	4	6.437	10.842	1.06	1.010	22.7
	MK-17	1	0.919	0	0.919	0.919	0.919
Yearly Average		4.06					
Standard Deviation		8.22					
Median		0.97					

Strontium Summary Statistics for Background Milk Sample Detections
Units are in picocuries per Liter (pCi/L)

Radionuclide:		Total Strontium-89/90					
Statistical Analysis:		**N**	**Avg.**	**St. Dev.**	**Median**	**Min**	**Max**
Background System Number:	**MK-30**	2	0.934	0.00636	0.934	0.929	0.938
Yearly Average		0.93					
Standard Deviation		0.006					
Median		0.93					

Strontium Summary Statistics for All Milk Sample Detections
Units are in picocuries per Liter (pCi/L)

Radionuclide:		Total Strontium-89/90					
Statistical Analysis:		**N**	**Avg.**	**St. Dev.**	**Median**	**Min**	**Max**
All Sample Numbers with Detections	**MK-8**	1	0.972	0	0.972	0.972	0.972
	MK-10	1	0.754	0	0.754	0.754	0.754
	MK-14	4	6.437	10.842	1.06	1.010	22.7
	MK-17	1	0.919	0	0.919	0.919	0.919
	MK-30	2	0.934	0.00636	.934	0.929	0.938
Yearly Average		3.36					
Standard Deviation		7.25					
Median		0.94					

Summary Statistics

Radiological Monitoring of Dairy Milk

Strontium Summary Statistics Comparison of Perimeter and Background Locations
Units are in picocuries per Liter (pCi/L)

	Perimeter Locations (E) (<50 miles)			Background locations (B) (>50 Miles)			E minus B	
	Average	**Std Dev.**	**Median**	**Average**	**Std Dev.**	**Median**	**Average**	**Median**
Sr-89/90	(N=7) 3.36	7.25	0.94	(N=2) 0.93	0.006	0.93	2.43	0.01

Back to List of Summary Statistics

4.1 Radiological Monitoring of Fish Adjacent to SRS

4.1.1 Summary

The Department of Energy-Savannah River (DOE-SR) has historically monitored the uptake of radionuclides in fish. However, DOE-SR reported results were not routinely evaluated by an independent monitoring source. Because of the size, scope and complexity of the activities at the Savannah River Site (SRS), the Environmental Surveillance and Oversight Program (ESOP) of the South Carolina Department of Health and Environmental Control (SCDHEC) was tasked with providing a non-regulatory independent monitoring and surveillance program at the SRS.

Radiocesium, released from 1954-1975, has been reported by DOE-SR as one of the most significant radionuclides related to human exposure (WSRC 1997). At SRS, the majority of liquid releases of cesium-137 (Cs-137) were due to leaking fuel rods in the 1950s and 1960s. Fuel rods were stored in basins, and Cs-137 was released to SRS streams when the basins were purged (WSRC 1999b). In the early 1970s, physical and administrative controls were implemented to control the releases of most fission and activation products. During subsequent years, tritium, which cannot be filtered from effluent streams, became more significant than cesium.

ESOP conducts fish monitoring for radionuclide activity in an effort to determine the magnitude, extent, and trends of radionuclide levels. Largemouth bass (*Micropterus salmoides)* and catfish (*Ameiurus catus* or *Ictalurus punctatus*) were collected from ten established sample locations and three random locations. Studies have shown that these species bioaccumulate measurable amounts of radionuclides. Chain pickerel (*Esox niger*) were also collected as part of an ongoing effort to sample additional species each study year. Red drum (*Sciaenops ocellatus*), spotted seatrout (*Cynoscion nebulosus*), and striped mullet (*Mugil cephalus*) were collected near Savannah, Georgia. Stations sampled in 2007 are shown in Section 4.1.2.

Fish were collected using boat-mounted electrofishing equipment. Samples were collected at five stations where creeks from the SRS meet the Savannah River. Samples were also collected from an upstream tributary of the river as a background location, one Savannah River station upstream of the SRS, and four stations downstream of the SRS. All these locations are accessible to the public. Typically, five fish of each species were collected at each sample location. Each species was separated into edible and nonedible portions, and the portions were combined into homogeneous composites. Edible composites were analyzed for gamma-emitting isotopes and tritium. Nonedible composites were analyzed for gamma-emitters and strontium.

Three locations did not produce samples with detectable tritium activity in 2007: the background site; the location upstream of SRS, and Upper Three Runs at the northern edge of SRS. All other locations adjacent to and downstream of SRS exhibited detectable tritium activity except the saltwater location. All locations except the background and saltwater locations exhibited Cs-137 activity. Activities of strontium-89,90 (Sr-89,90) were reported from all locations.

The DOE-SR also conducts fish monitoring to assess the environmental effects of current and historical releases of radionuclides. ESOP data were compared to DOE-SR reported results. Dissimilarities in these results could be attributed to the natural variation of radionuclide levels. Although there are differences between reported values, the data is consistent with historically

reported data. In the past, samples have been collected and split between SCDHEC and DOE-SR for analyses, and no great variations in the data results were found. This would potentially rule out methodology differences and substantiate that differences result from the variability in samples analyzed by the two programs.

Independent monitoring of radionuclide levels in Savannah River fish will continue along with evaluating the DOE-SR Radiological Fish Monitoring Program. The information provided will assist in advising, informing, and protecting the people at risk, and in comparing current and historical data.

RESULTS AND DISCUSSION

The following radionuclides were not detected above the minimum detectable activity in 2007: beryllium-7 (Be-7), sodium-22 (Na-22), manganese-54 (Mn-54), cobalt-58 (Co-58), cobalt-60 (Co-60), zinc-65 (Zn-65), yttrium-88 (Y-88), zirconium-95 (Zr-95), ruthenium-103 (Ru-103), antimony-125 (Sb-125), iodine-131(I-131), cesium-134 (Cs-134), cerium-144 (Ce-144), europium-152 (Eu-152), europium-154 (Eu-154), europium-155 (Eu-155), lead-212 (Pb-212), radium-226 (Ra-226), actinium-228 (Ac-228), uranium/thorium-238 (U/Th-238), and americium-241 (Am-241).

Fish collections were conducted from April 3 through October 9, 2007. Five largemouth bass were collected from all Savannah River locations and the Stevens Creek background site. Five channel catfish were collected at five Savannah River locations; five white catfish were collected at four other river locations. Although several attempts were made, no catfish were collected from Stevens Creek. Chain pickerel were collected at four Savannah River stations. Five red drum, five spotted seatrout, and five mullet were collected from the saltwater location.

A total of 118 fish was collected. Fifty-three composites, one individual, and two single fish samples were processed. The SCDHEC Region 5 tritium laboratory analyzed aliquots from all edible samples except chain pickerel, which did not produce enough tissue for multiple analyses. Edible and non-edible samples were sent to the SCDHEC Radiological Environmental Monitoring Division in Columbia, South Carolina, for radiological analysis of gamma-emitting radionuclides. Portions of some non-edible and two edible samples were sent to Eberline Services for strontium analysis. Graphic presentations of 2007 and 2003-2007 activity levels of tritium, cesium-137 (Cs-137), and strontium-89,90 (Sr-89,90) are reported in Section 4.1.3. Activity levels of radionuclides for all samples and ESOP historical data from 2003 – 2007 are reported in Section 4.1.4. Summary statistics are presented in Section 4.1.5. Tritium results represent the activity level in the water distilled from the fish tissue. Cesium results represent the activity level in the wet sample itself. Strontium data are presented as dry and wet (converted) results.

Tritium

Tritium is a naturally occurring radioisotope, although in very low concentrations (USEPA 2007). Sources of man-made tritium include nuclear reactors and government weapons production plants. Tritium releases at SRS include both atmospheric and liquid contributions (WSRC 2008a). Although the United States Environmental Protection Agency (USEPA) has not established a Maximum Contaminant Level (MCL) for tritium in solid media (e.g. fish,

vegetation), the MCL for drinking water has been set at 20,000 picocuries per liter (pCi/L) (USEPA 2008b).
Activity levels of tritium were analyzed in 22 edible composites and one individual sample. Seven of the ten freshwater stations exhibited detectable tritium activity in 2007 (Figure 1a, Section 4.1.3); the saltwater sampling location did not. The Stevens Creek background location, above a hydro-electric generating plant spillway that completely blocks movement of fish from the lower Savannah River, did not exhibit tritium activity. The uppermost Savannah River location near the New Savannah Bluff Lock and Dam and the location near Upper Three Runs also had no tritium activity. All stations downstream of Upper Three Runs exhibited tritium activity.

Six of nine bass samples from the Savannah River exhibited detectable tritium activity, with an average of 811 (± 1045) pCi/L. The composite from the Fourmile Creek location had the highest reported tritium activity, 2930 pCi/L. Seven of nine Savannah River catfish samples exhibited tritium activity, with an average of 734 (± 636) pCi/L. The highest tritium level observed in the catfish composites, 2010 pCi/L, was also from the Fourmile Creek location.

Chain pickerel were not analyzed for tritium because not enough tissue was available.

Samples from downstream of SRS exhibited little tritium activity in 2007. 2007 data were generally similar to ESOP historically reported data (Figures 1b,1c, Section 4.1.3) (SCDHEC 2007f).

Gamma

The naturally occurring isotope of potassium-40, K-40, was detected from all stations where gamma samples were collected in 2007. The lead isotope Pb-214 was also detected, but not from all locations. Because these are naturally occurring isotopes, the results will not be discussed in this report, but are presented in Section 6.0.

Cesium-137 (Cs-137) is a man-made fission product, and was a constituent of air and water releases on SRS, mainly from F- and H-Areas. Liquid releases also occurred from the production reactors as a result of leaking fuel elements in the 1950s and 1960s, and reactor basin purges were discharged to SRS streams, including Fourmile Creek, Steel Creek, and Lower Three Runs (WSRC 1999b).

Activity levels of Cs-137 were analyzed in 43 edible and nonedible portions of bass, catfish, and pickerel composites, two single samples, and one individual sample. The Stevens Creek background location and the saltwater location, including the shrimp, did not exhibit Cs-137 activity in any sample (Figure 2a/3a/4, Section 4.1.3).

Eight of nine edible bass composites from Savannah River locations exhibited detectable levels of Cs-137, ranging from 0.027 to 0.473 picocuries per gram (pCi/g), with an average of 0.129 (± 0.148) pCi/g (Figure 2a, Section 4.1.3). The sample from the Lower Three Runs location had the highest reported activity level. Cs-137 levels reported above the Minimum Detectable Activity (MDA) were observed in edible bass composites from all locations adjacent to and downstream of the SRS. Cs-137 activity was detected in nonedible bass composites from four creek mouth locations adjacent to SRS and one downstream location.

Six edible catfish composites exhibited detectable levels of Cs-137, ranging from 0.028 to 0.342 pCi/g, with an average of 0.096 (± 0.122) pCi/g (Figure 3a, Section 4.1.3). Three nonedible catfish composites produced detectable Cs-137 activity. The Fourmile Creek location exhibited the highest activity for both the edible and nonedible samples.

Three of four edible chain pickerel composites exhibited detectable levels of Cs-137, ranging from 0.025 to 0.102 pCi/g, with an average of 0.066 (± 0.039) pCi/g. The sample from the Lower Three Runs location had the highest reported activity level.

Consistent with historically reported ESOP data, higher levels of Cs-137 were reported from locations adjacent to the SRS, especially Fourmile Creek, Steel Creek, and Lower Three Runs (Figure 2b,2c/3b,3c, Section 4.1.3) (SCDHEC 2007f). Higher activity levels in samples from these locations are not unexpected based on historical releases to these streams and the Savannah River swamp, and the Cs-137 contamination still present.

Strontium

ESOP contracted with a private laboratory for "total strontium"-strontium-89,90 (Sr-89,90)-analysis of fish samples in 2007. Strontium-89 and -90 are present around the world as a result of fallout from past atmospheric nuclear weapons tests (MII 2008). Strontium-90 is the more important isotope in the environment, although strontium-89 can be found around reactors. Strontium-90 behaves like calcium in the body, and tends to deposit in bone and bone marrow. Internal exposure is linked to several forms of cancer (USEPA 2007).

Portions of 17 nonedible composites, one edible composite, and one edible individual sample were selected for Sr-89,90 analysis in 2007. All locations produced detectable strontium activity, including the upstream background station (Figure 5a, Section 4.1.3). Sr-89,90 levels reported are for wet results, calculated from the actual dry analysis. Averages noted below are for Savannah River freshwater species only, excluding the Stevens Creek location.

Levels of Sr-89,90 in bass ranged from 0.078 to 0.173 pCi/g, with an average of 0.126 (± 0.039**)** pCi/g. The sample from the Fourmile Creek location had the highest reported activity level, Beaver Dam Creek exhibited the second highest, 0.170 pCi/g. Strontium levels in catfish samples ranged from 0.003 to 0.109 pCi/g, with an average of 0.066 (± 0.034) pCi/g. The Beaver Dam Creek location exhibited the highest activity. For comparison, the USEPA has established an MCL of 8 pCi/L in public drinking water for beta emitters such as Sr-90.

Figures 5b and 5c, Section 4.1.3, show historically reported ESOP data for Sr-89,90 (SCDHEC 2007f). The data reflects the results of the dry analysis of the samples because no wet/dry conversion ratios were available for most of the data. Results are highly variable.

Individual Fish Analyses

Larger, older fish may bioaccumulate more contaminants over time (USEPA 2000b). ESOP analyzed and compared data from one large fish versus the composite it was a part of in order to ascertain the impact a large fish might have on a composite sample. An edible portion of one bass from the Highway 301 location was analyzed separately for tritium and gamma activity.

The tritium detected in the sample, 345 pCi/L, was nearly the same as the corresponding composite sample, 396 pCi/L. Similarly, the gamma analysis of the individual fish produced a Cs-137 activity very close to the corresponding composite sample, 0.020 and 0.027 pCi/g, respectively. In this instance, the larger fish would not have increased the radionuclide activity in the composite sample.

DOE-SR Program

ESOP bass and catfish data collected for this project in 2007 were compared to DOE-SR reported information (WSRC 2008a). Data comparison summaries are located in Section 4.1.4. One difference between the two programs is that ESOP analyzes one composite type from each species for each location, whereas the DOE-SR program analyzes three per location. Therefore, a single composite for an ESOP location was compared to the average of the three DOE-SR composites reported.

ESOP detected tritium in fish from seven of nine Savannah River freshwater locations, while DOE-SR detected tritium at only two locations. Six ESOP largemouth bass samples exhibited tritium activity, while none of the DOE-SR samples did. ESOP and DOE-SR both detected tritium in catfish samples from the Steel Creek and Highway 17 locations. Cs-137 was detected in largemouth bass from most locations by both programs in 2007, especially adjacent to SRS, but not as frequently in catfish. Cs-137 results for bass and catfish from ESOP and DOE-SR were less than 1.00 pCi/g. Strontium-89,90 was detected at all locations by both programs, although all values were less than 1.00 pCi/g. Americium-241 was not detected by ESOP in any fish samples, DOE-SR samples produced two detections at very low levels (< 0.0001 pCi/g) (WSRC 2008a).

For direct comparisons of data between the two programs, only averages of detections were used. For tritium in catfish, DOE-SR results were within one standard deviation of the ESOP results. For all Cs-137 samples, DOE-SR results were within one standard deviation of the ESOP results. Sr-89,90 results for bass were within two standard deviations; catfish were within one standard deviation.

CONCLUSIONS AND RECOMMENDATIONS

A review of ESOP data indicates that DOE-SR operations have impacted fish. Higher levels of radionuclides are found in Savannah River fish collected adjacent to and downstream of SRS compared to upstream. Previous studies have shown that tritium and cesium in the SRS environment from historical and continuing releases can be manifested in the SRS biota (Cummins 1994; WSRC 1997). Fish from background locations tend not to exhibit detectable levels of man-made radionuclides, except for Sr-89,90, which is present worldwide from past nuclear weapons testing (USEPA 2007).

The project attempted to determine if activity levels in larger fish might impact a composite of relatively smaller fish. Separate portions of one bass, considerably larger than the other fish sampled, were analyzed and compared to the respective composites. Results of the tritium and gamma analyses of the bass indicated that the larger fish did not make a significant contribution to the composite sample. Collections of larger fish will continue in 2008 to provide additional data for assessment.

ESOP project data was compared to DOE-SR reported information (WSRC 2008a). Based on standard deviations, compared tritium, Cs-137, and Sr-89,90 data were generally similar. Differences in results could be due to the natural variation of radionuclide levels in individual fish. Both programs detected Sr-89,90 at all locations.

The ESOP 2007 fish collections included chain pickerel. The ESOP monitoring program will continue to collect chain pickerel in 2008, in addition to the target species, at locations where they were not collected in 2007. Future analyses of the target species may include selected metals analysis. This will augment the existing data on Savannah River fish, provide information for human health assessment, and provide another basis for comparison of results with DOE-SR data on metals.

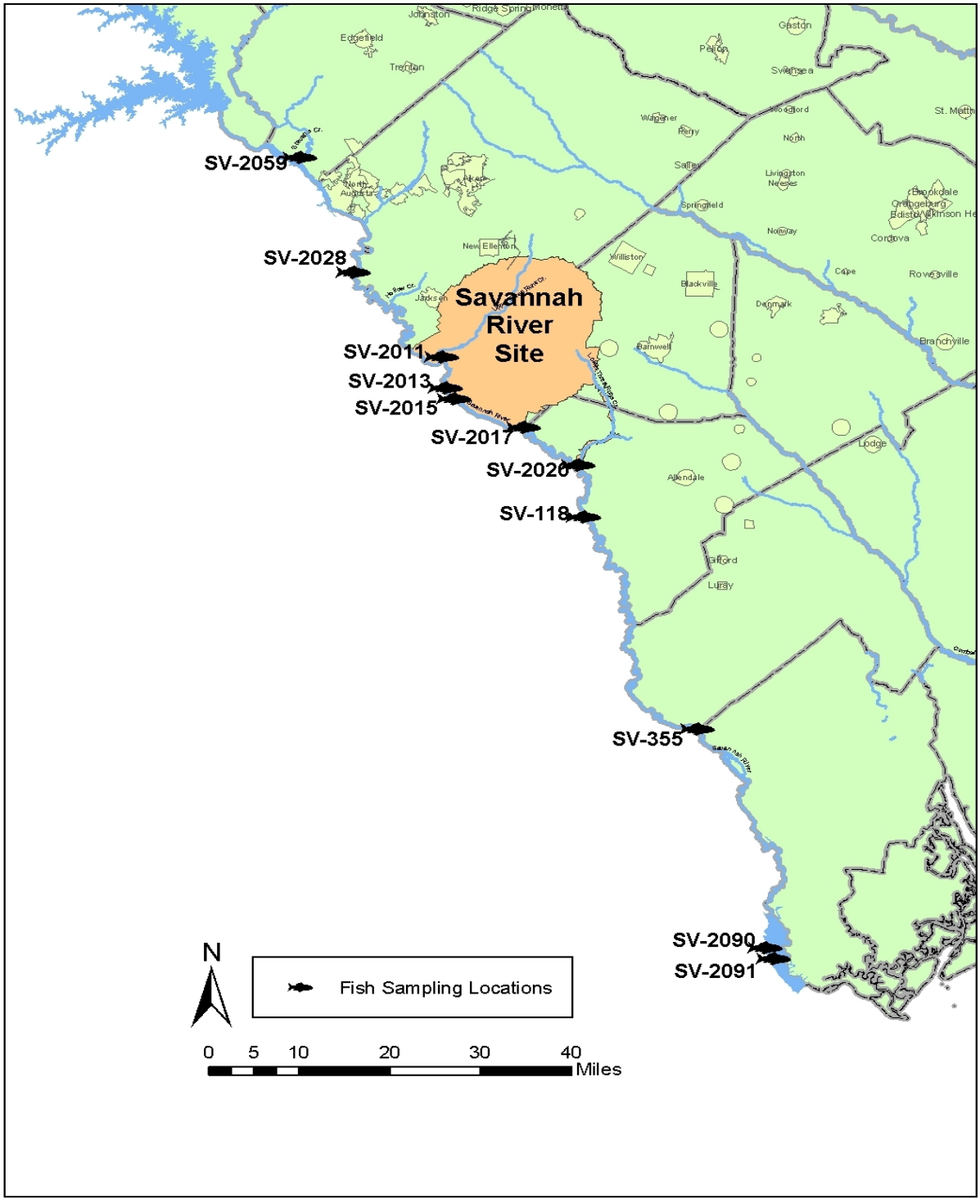
Independent monitoring of radionuclide levels in Savannah River fish will continue along with evaluating the DOE-SR Radiological Fish Monitoring Program. Continued monitoring will provide a better understanding of actual radionuclide levels, their extent, and trends. Several important benefits can be realized as a result. Foremost is the ability for SCDHEC Bureau of Water and the Division of Health Hazard Evaluation to further evaluate the potential human health risk associated with consumption of Savannah River fish. SCDHEC will be able to better advise, inform, and protect those people at risk. Although Cs-137 and Sr-89,90 are found in some Savannah River fish, the levels are low and have decreased over time. If the public follows the SCDHEC mercury advisories for consumption of fish from the river, the health risk from these radioactive elements is very low (SCDHEC 2008). Another benefit will be the ability to compare this data with historical data. Data comparison will also be part of the further evaluation of the DOE-SR program, allowing the data reported by DOE-SR to be verified. This independent verification will provide credibility and confidence in the DOE-SR data and its uses.

Back to Table of Contents

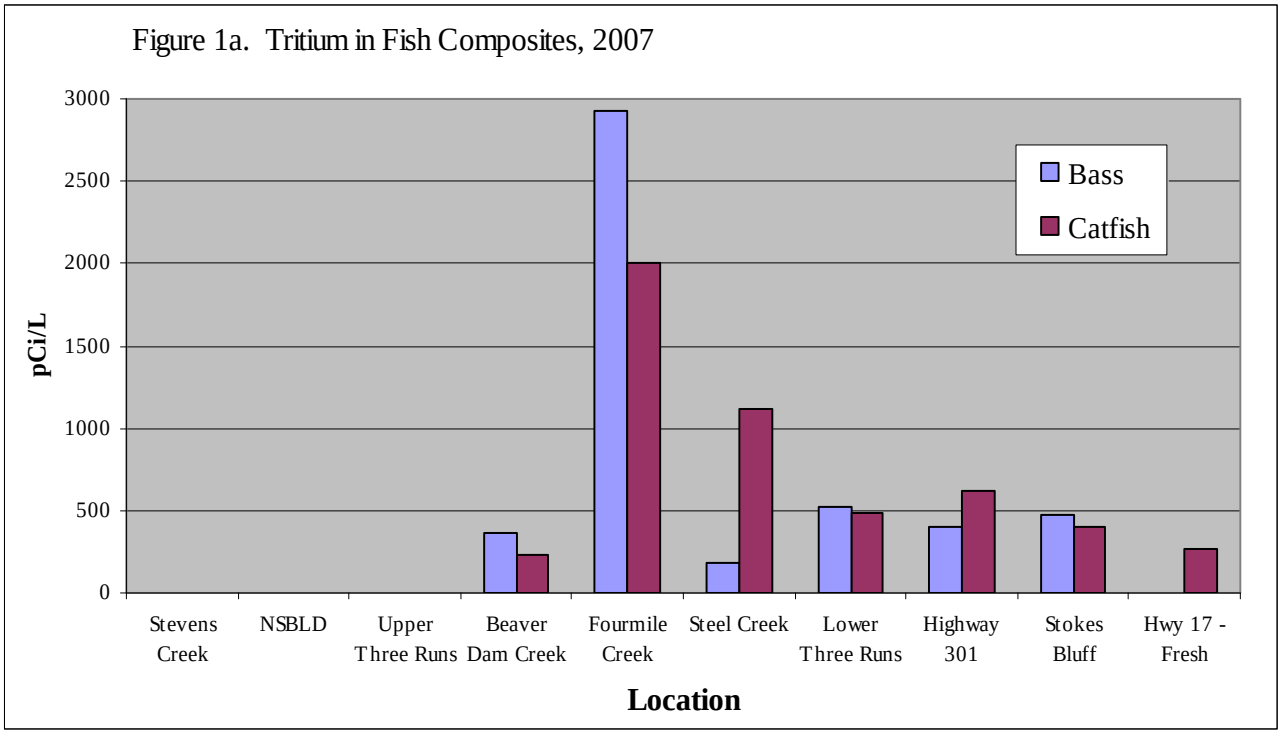
4.1.2

Map 11. Radiological Monitoring of Fish, Sampling Locations, 2007

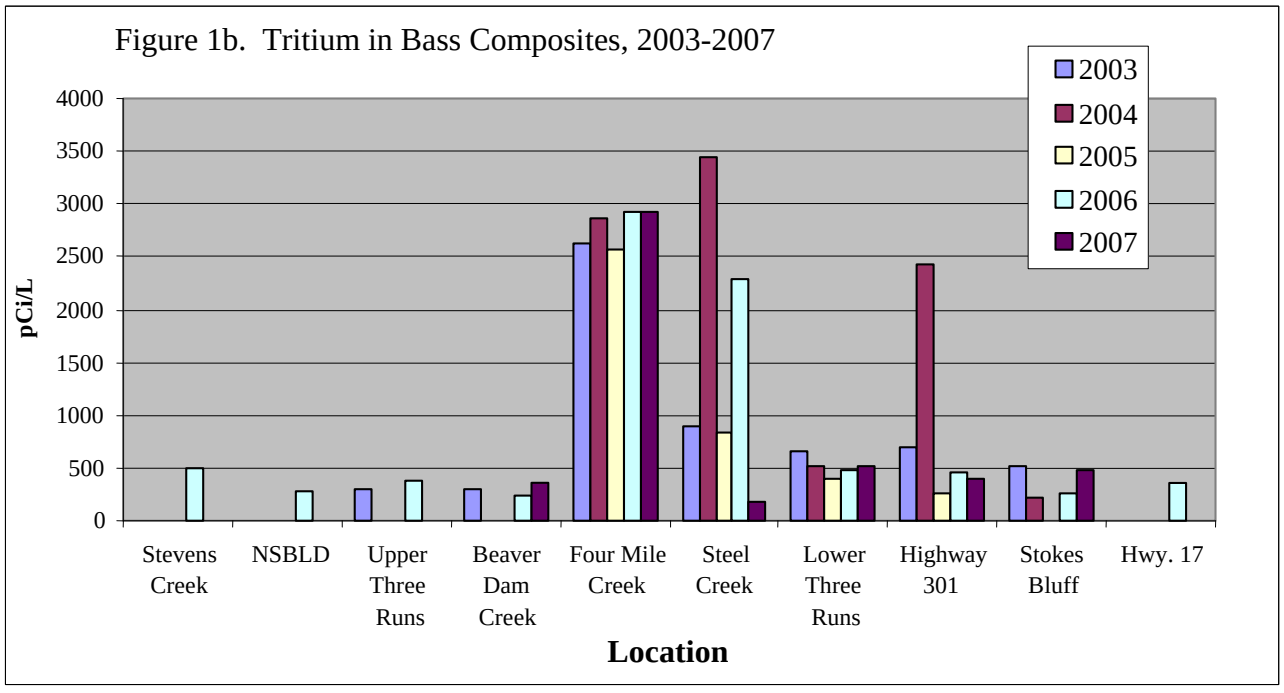
Back to Maps



4.1.3 Tables and Figures
Radiological Monitoring of Fish

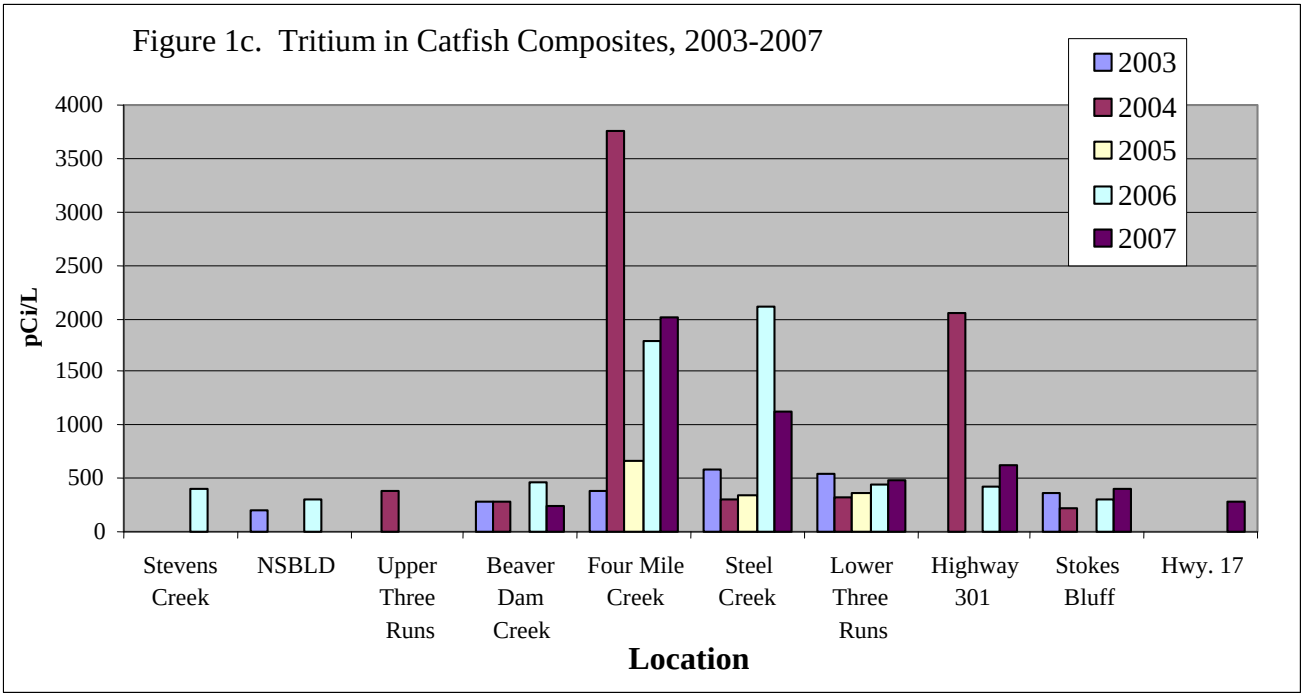


Note: No saltwater species produced detectable tritium activity

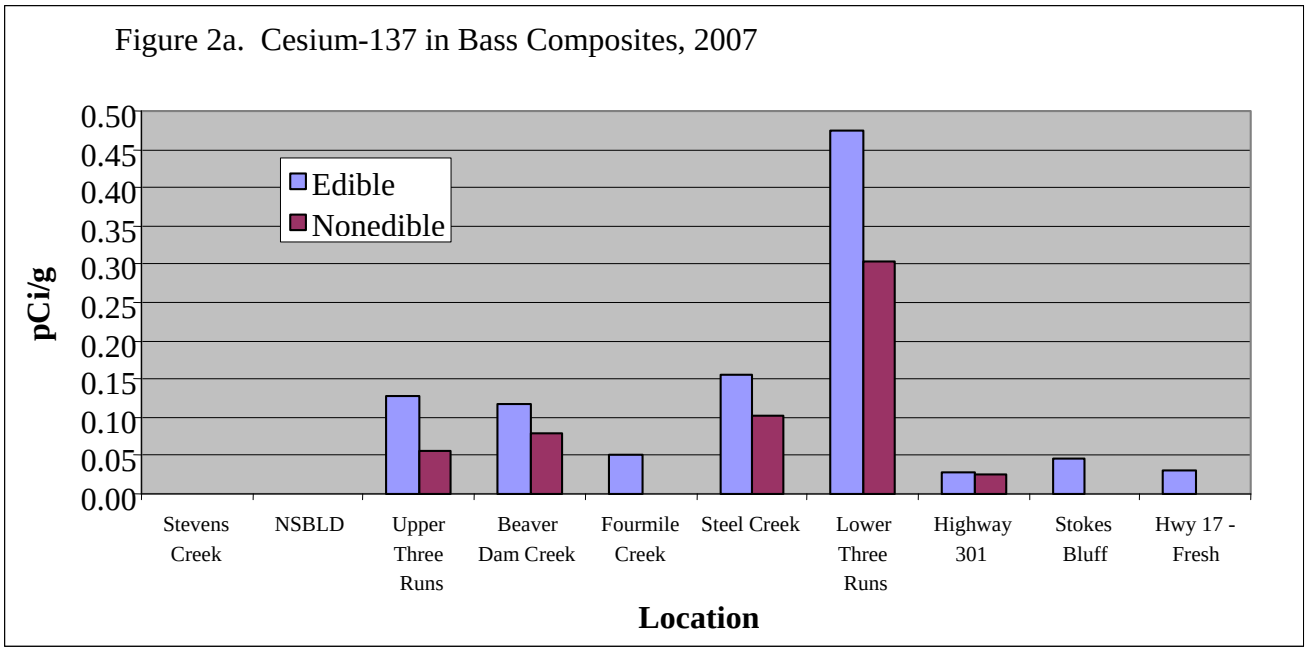


Note: Sampling at the Hwy. 17 location started in 2006

Tables and Figures
Radiological Monitoring of Fish

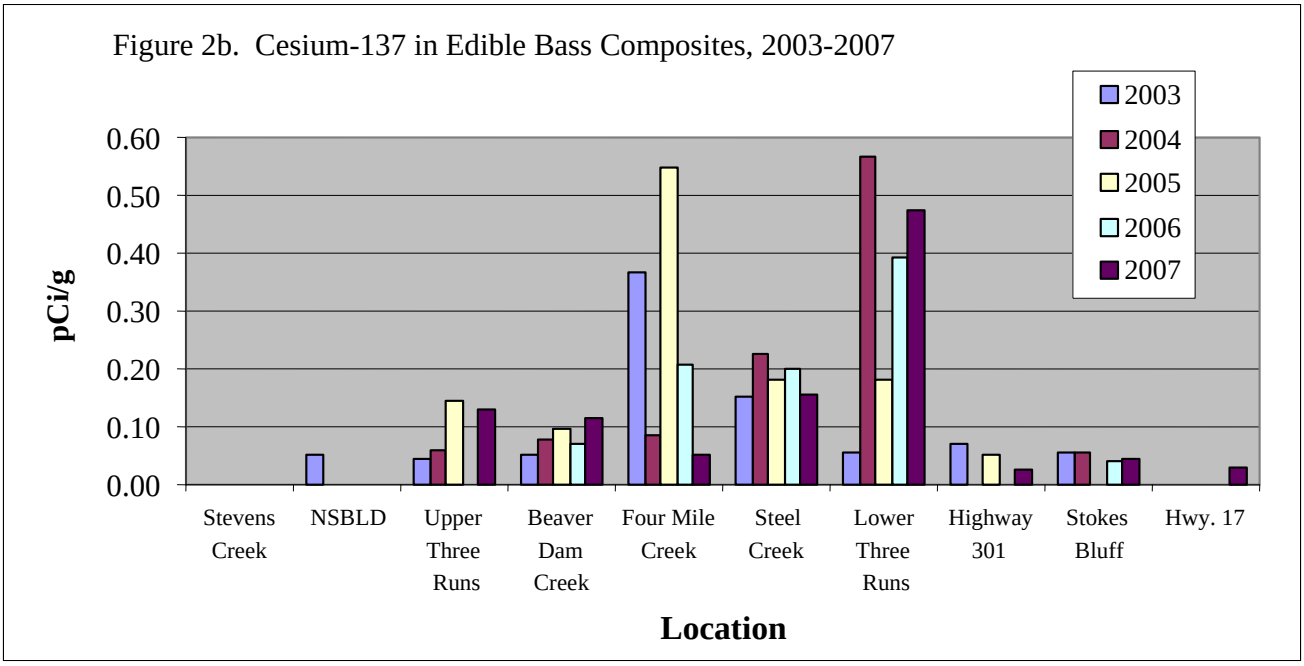


Note: Sampling at the Hwy. 17 location started in 2006

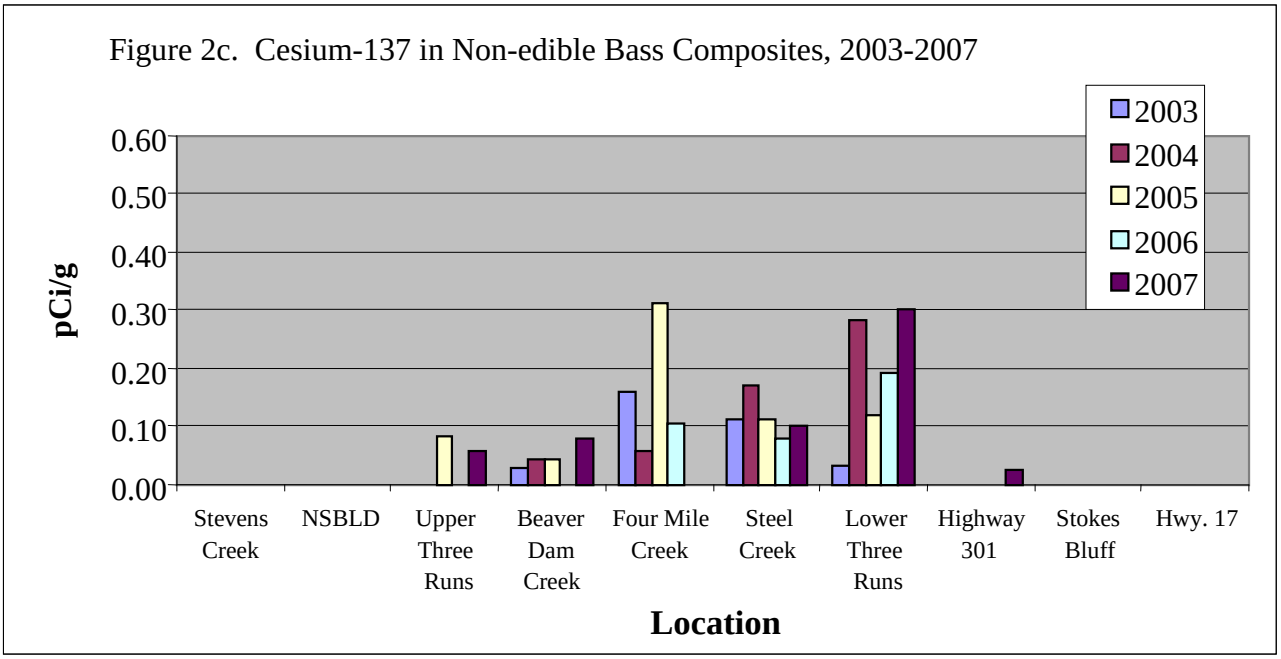


Note: No saltwater species produced detectable Cs-137 activity

Tables and Figures
Radiological Monitoring of Fish



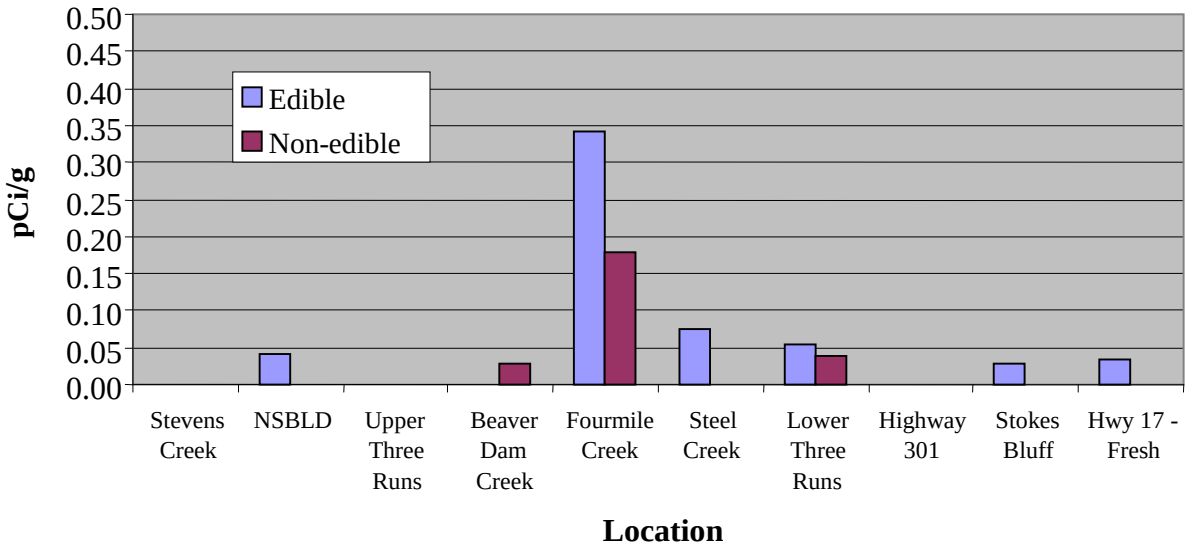
Note: Sampling at the Hwy. 17 location started in 2006



Note: Sampling at the Hwy. 17 location started in 2006

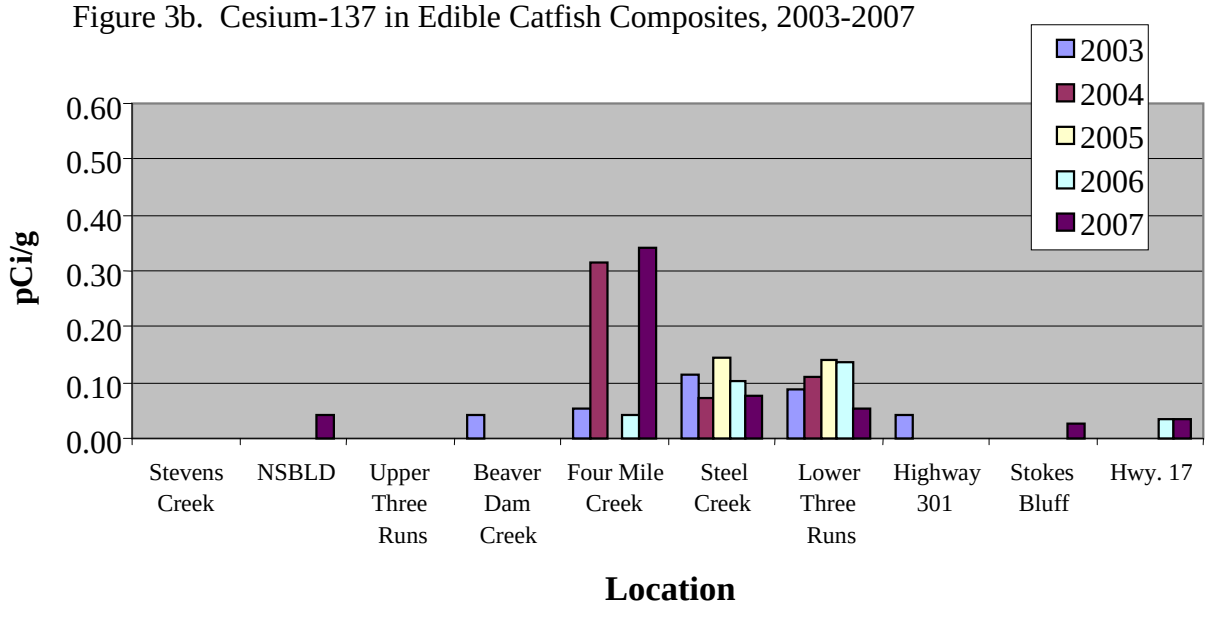
Tables and Figures
Radiological Monitoring of Fish

Figure 3a. Cesium-137 in Catfish Composites, 2007



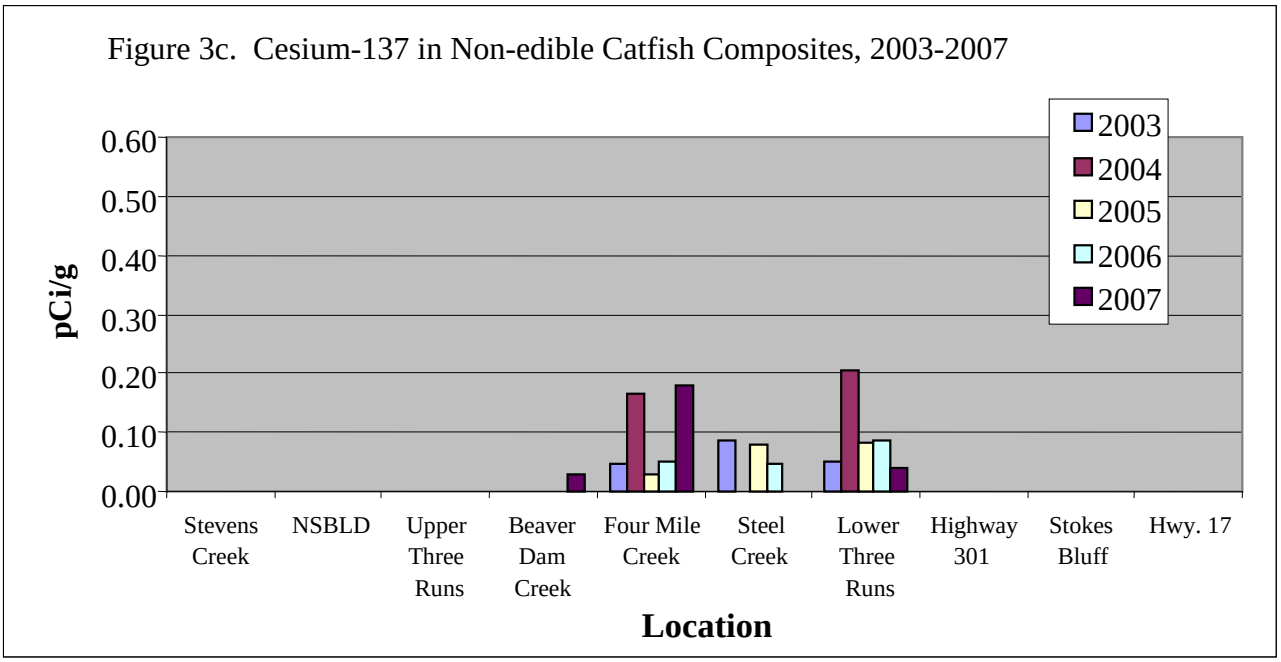
Note: No catfish collected from Stevens Creek

Figure 3b. Cesium-137 in Edible Catfish Composites, 2003-2007

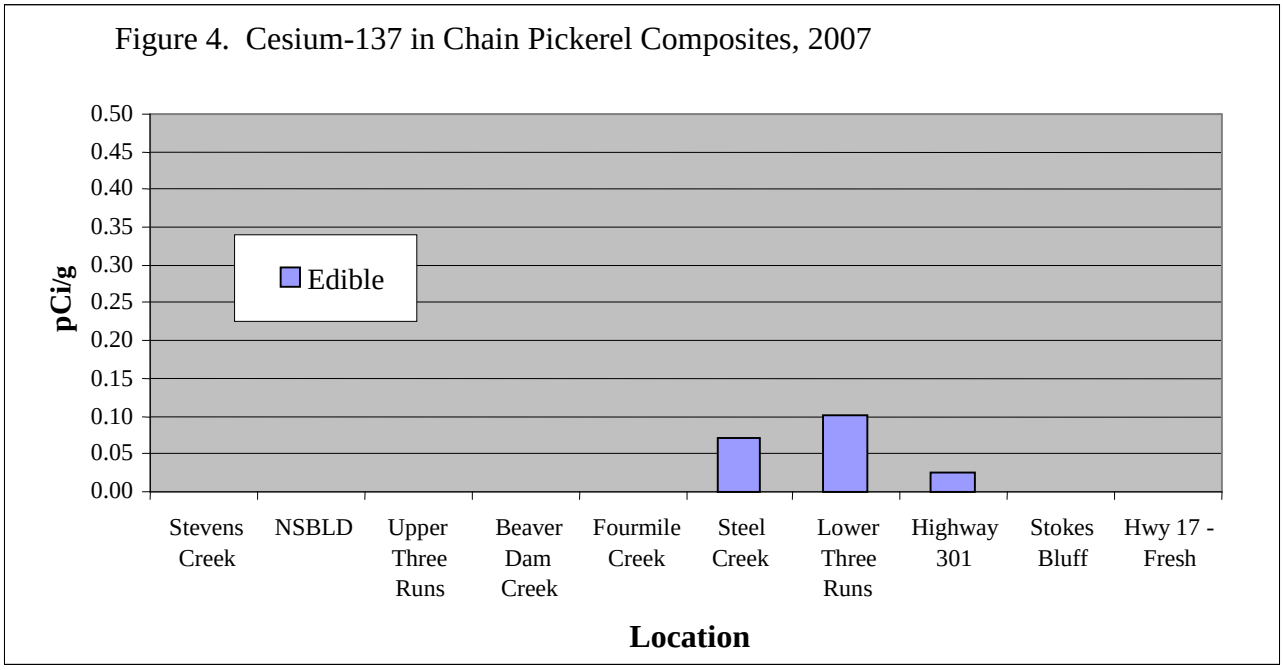


Note: Sampling at the Hwy. 17 location started in 2006

Tables and Figures
Radiological Monitoring of Fish

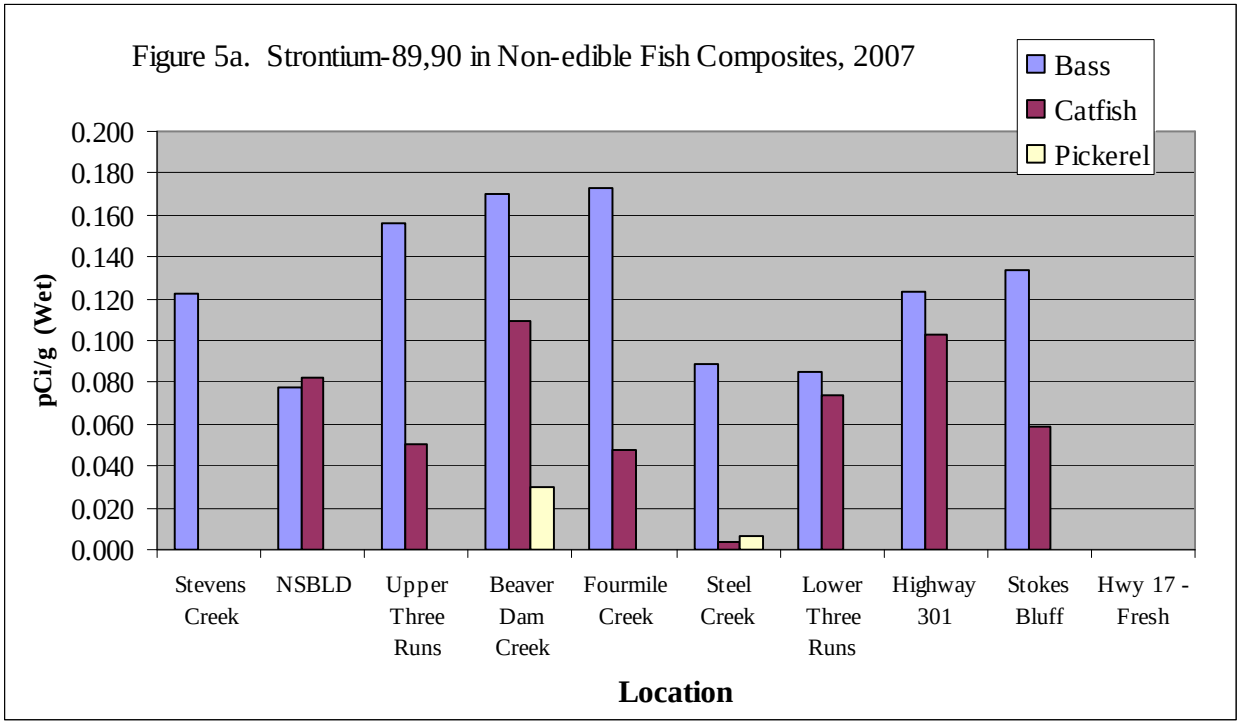


Note: Sampling at the Hwy. 17 location started in 2006

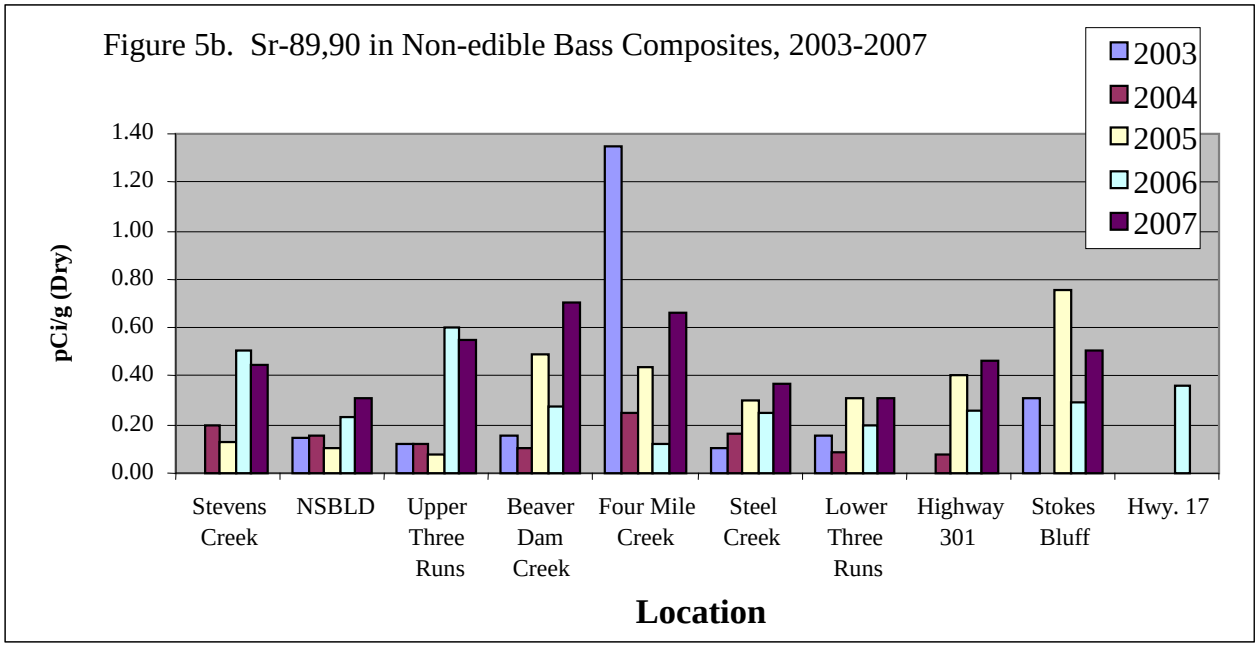


Note: Pickerel collected only at Beaver Dam Creek, Steel Creek, Lower Three Runs, and Hwy. 301

Tables and Figures
Radiological Monitoring of Fish

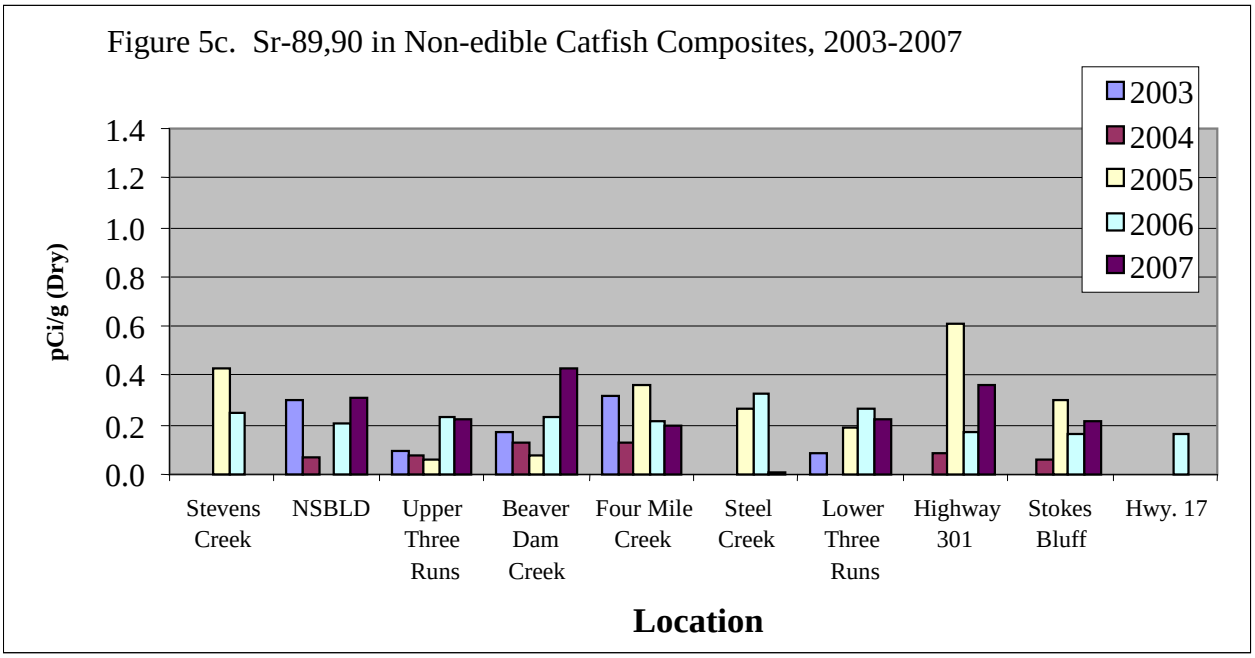


Note: Edible composites of pickerel were analyzed from listed stations only.
Catfish not collected from Stevens Creek
Saltwater species were not analyzed for strontium



Note: Stevens Creek not analyzed in 2003
Sampling at the Hwy. 17 location started in 2006

Tables and Figures
Radiological Monitoring of Fish



Note: Stevens Creek analyzed only in 2005 and 2006
Sampling at the Hwy. 17 location started in 2006

Back to Tables and Figures

4.1.4 Data

Radiological Monitoring of Fish

Radionuclides Data.....347

ESOP Historical Data, 2003-2007.....369

ESOP and DOE-SR Data Comparison.....370

Notes:

1. LLD - Lower Limit of Detection
2. MDA - Minimum Detectable Activity
3. MDC - Minimum Detectable Concentration
4. NSBLD - New Savannah Bluff Lock & Dam
5. Hwy. 301 - Savannah River at U.S. Highway 301
6. Hwy. 17 - Savannah River at U.S. Highway 17

Back to List of Data Tables

Radiological Monitoring of Fish
Radionuclides Data

Sample Location		Stevens Creek	Stevens Creek	Stevens Creek
Sample Station		SV-2059	SV-2059	SV-2059
Sample Date		4/10/2007	4/10/2007	
Sample Cut		Edible	Non-edible	Edible
Species		Bass	Bass	Catfish
	Tritium (pCi/L)	Non-detect	Not Analyzed	None collected
	+/- 2 Sigma			
	LLD	175		
Tritium (pCi)/gram of water in tissue				
Radionuclides (pCi/g)	Cs-137 **(Wet)**	Non-detect	Non-detect	None collected
	+/- 2 Sigma			
	MDA	0.016	0.017	
	Sr-89/90 **(Wet)**	Not Analyzed	0.122	None collected
	+/- 2 Sigma		0.010	
	MDC		0.005	
	Sr-89/90 **(Dry)**	Not Analyzed	0.449	None collected
	+/- 2 Sigma		0.036	
	MDC		0.018	

Sample Location		Stevens Creek
Sample Station		SV-2059
Sample Date		
Sample Cut		Non-edible
Species		Catfish
	Tritium (pCi/L)	Not Analyzed
	+/- 2 Sigma	
	LLD	
Radionuclides (pCi/g)	Cs-137 **(Wet)**	None collected
	+/- 2 Sigma	
	MDA	
	Sr-89/90 **(Wet)**	None collected
	+/- 2 Sigma	
	MDC	
	Sr-89/90 **(Dry)**	None collected
	+/- 2 Sigma	
	MDC	

1. Tritium results (pCi/L) represent the activity level in the water distilled from the fish tissue
2. Cs-137 results represent the activity level in actual fish tissue
3. Strontium results represent the activity level in an aliquot of fish tissue
4. Non-detect denotes <LLD or <MDA or <MDC

Radiological Monitoring of Fish
Radionuclides Data

Sample Location		NSBLD	NSBLD	NSBLD
Sample Station		SV-2028	SV-2028	SV-2028
Sample Date		4/3/2007	4/3/2007	4/3/2007
Sample Cut		Edible	Non-edible	Edible
Species		Bass	Bass	Catfish
	Tritium (pCi/L)	Non-detect	Not Analyzed	Non-detect
	+/- 2 Sigma			
	LLD	175		175
Tritium (pCi)/gram of water in tissue				
Radionuclides	Cs-137 **(Wet)**	Non-detect	Non-detect	0.041
(pCi/g)	+/- 2 Sigma			0.018
	MDA	0.017	0.017	0.014
	Sr-89/90 **(Wet)**	Not Analyzed	0.078	Not Analyzed
	+/- 2 Sigma		0.007	
	MDC		0.005	
	Sr-89/90 **(Dry)**	Not Analyzed	0.306	Not Analyzed
	+/- 2 Sigma		0.027	
	MDC		0.019	

Sample Location		NSBLD
Sample Station		SV-2028
Sample Date		4/3/2007
Sample Cut		Non-edible
Species		Catfish
	Tritium (pCi/L)	Not Analyzed
	+/- 2 Sigma	
	LLD	
Tritium (pCi)/gram of water in tissue		
Radionuclides	Cs-137 **(Wet)**	Non-detect
(pCi/g)	+/- 2 Sigma	
	MDA	0.015
	Sr-89/90 **(Wet)**	0.082
	+/- 2 Sigma	0.007
	MDC	0.006
	Sr-89/90 **(Dry)**	0.306
	+/- 2 Sigma	0.027
	MDC	0.022

1. Tritium results (pCi/L) represent the activity level in the water distilled from the fish tissue
2. Cs-137 results represent the activity level in actual fish tissue
3. Strontium results represent the activity level in an aliquot of fish tissue
4. Non-detect denotes <LLD or <MDA or <MDC

Radiological Monitoring of Fish
Radionuclides Data

Sample Location		Upper Three Runs	Upper Three Runs	Upper Three Runs
Sample Station		SV-2011	SV-2011	SV-2011
Sample Date		4/5/2007	4/5/2007	4/5/2007
Sample Cut		Edible	Non-edible	Edible
Species		Bass	Bass	Catfish
	Tritium (pCi/L)	Non-detect	Not Analyzed	Non-detect
	+/- 2 Sigma			
	LLD	175		175
Tritium (pCi)/gram of water in tissue				
Radionuclides	Cs-137 **(Wet)**	0.129	0.057	Non-detect
(pCi/g)	+/- 2 Sigma	0.024	0.017	
	MDA	0.018	0.015	0.018
	Sr-89/90 **(Wet)**	Not Analyzed	0.156	Not Analyzed
	+/- 2 Sigma		0.013	
	MDC		0.006	
	Sr-89/90 **(Dry)**	Not Analyzed	0.550	Not Analyzed
	+/- 2 Sigma		0.044	
	MDC		0.022	

Sample Location		Upper Three Runs
Sample Station		SV-2011
Sample Date		4/5/2007
Sample Cut		Non-edible
Species		Catfish
	Tritium (pCi/L)	Not Analyzed
	+/- 2 Sigma	
	LLD	
Tritium (pCi)/gram of water in tissue		
Radionuclides	Cs-137 **(Wet)**	Non-detect
(pCi/g)	+/- 2 Sigma	
	MDA	0.017
	Sr-89/90 **(Wet)**	0.051
	+/- 2 Sigma	0.005
	MDC	0.004
	Sr-89/90 **(Dry)**	0.225
	+/- 2 Sigma	0.021
	MDC	0.018

1. Tritium results (pCi/L) represent the activity level in the water distilled from the fish tissue
2. Cs-137 results represent the activity level in actual fish tissue
3. Strontium results represent the activity level in an aliquot of fish tissue
4. Non-detect denotes <LLD or <MDA or <MDC

Radiological Monitoring of Fish
Radionuclides Data

Sample Location		Beaver Dam Creek	Beaver Dam Creek	Beaver Dam Creek
Sample Station		SV-2013	SV-2013	SV-2013
Sample Date		4/12/2007	4/12/2007	4/12/2007
Sample Cut		Edible	Non-edible	Edible
Species		Bass	Bass	Catfish
	Tritium (pCi/L)	359	Not Analyzed	233
	+/- 2 Sigma	89		84
	LLD	175		175
Tritium (pCi)/gram of water in tissue		0.359		0.233
Radionuclides	Cs-137 **(Wet)**	0.117	0.079	Non-detect
(pCi/g)	+/- 2 Sigma	0.025	0.020	
	MDA	0.017	0.014	0.017
	Sr-89/90 **(Wet)**	Not Analyzed	0.170	Not Analyzed
	+/- 2 Sigma		0.013	
	MDC		0.005	
	Sr-89/90 **(Dry)**	Not Analyzed	0.705	Not Analyzed
	+/- 2 Sigma		0.055	
	MDC		0.021	

Sample Location		Beaver Dam Creek	Beaver Dam Creek
Sample Station		SV-2013	SV-2013
Sample Date		4/12/2007	4/12/2007
Sample Cut		Non-edible	Edible
Species		Catfish	Chain pickerel
	Tritium (pCi/L)	Not Analyzed	Not Analyzed
	+/- 2 Sigma		
	LLD		
Tritium (pCi)/gram of water in tissue			
Radionuclides	Cs-137 **(Wet)**	0.028	Non-detect
(pCi/g)	+/- 2 Sigma	0.014	
	MDA	0.014	0.016
	Sr-89/90 **(Wet)**	0.109	0.030
	+/- 2 Sigma	0.009	0.003
	MDC	0.005	0.003
	Sr-89/90 **(Dry)**	0.433	0.146
	+/- 2 Sigma	0.036	0.015
	MDC	0.020	0.014

1. Tritium results (pCi/L) represent the activity level in the water distilled from the fish tissue
2. Cs-137 results represent the activity level in actual fish tissue
3. Strontium results represent the activity level in an aliquot of fish tissue
4. Non-detect denotes <LLD or <MDA or <MDC

Radiological Monitoring of Fish
Radionuclides Data

Sample Location		Fourmile Creek	Fourmile Creek	Fourmile Creek
Sample Station		SV-2015	SV-2015	SV-2015
Sample Date		4/13/2007	4/13/2007	4/13/2007
Sample Cut		Edible	Non-edible	Edible
Species		Bass	Bass	Catfish
	Tritium (pCi/L)	2930	Not Analyzed	2010
	+/- 2 Sigma	165		143
	LLD	175		175
Tritium (pCi)/gram of water in tissue		2.93		2.01
Radionuclides	Cs-137 **(Wet)**	0.052	Non-detect	0.342
(pCi/g)	+/- 2 Sigma	0.017		0.036
	MDA	0.016	0.016	0.012
	Sr-89/90 **(Wet)**	Not Analyzed	0.173	Not Analyzed
	+/- 2 Sigma		0.014	
	MDC		0.005	
	Sr-89/90 **(Dry)**	Not Analyzed	0.661	Not Analyzed
	+/- 2 Sigma		0.052	
	MDC		0.020	

Sample Location		Fourmile Creek
Sample Station		SV-2015
Sample Date		4/13/2007
Sample Cut		Non-edible
Species		Catfish
	Tritium (pCi/L)	Not Analyzed
	+/- 2 Sigma	
	LLD	
Tritium (pCi)/gram of water in tissue		
Radionuclides	Cs-137 **(Wet)**	0.178
(pCi/g)	+/- 2 Sigma	0.027
	MDA	0.015
	Sr-89/90 **(Wet)**	0.047
	+/- 2 Sigma	0.004
	MDC	0.003
	Sr-89/90 **(Dry)**	0.200
	+/- 2 Sigma	0.018
	MDC	0.013

1. Tritium results (pCi/L) represent the activity level in the water distilled from the fish tissue
2. Cs-137 results represent the activity level in actual fish tissue
3. Strontium results represent the activity level in an aliquot of fish tissue
4. Non-detect denotes <LLD or <MDA or <MDC

Radiological Monitoring of Fish
Radionuclides Data

Sample Location		Steel Creek	Steel Creek	Steel Creek
Sample Station		SV-2017	SV-2017	SV-2017
Sample Date		5/16/2007	5/16/2007	4/18/2007
Sample Cut		Edible	Non-edible	Edible
Species		Bass	Bass	Catfish
	Tritium (pCi/L)	183	Not Analyzed	1120
	+/- 2 Sigma	82		117
	LLD	175		175
Tritium (pCi)/gram of water in tissue		0.183		1.120
Radionuclides	Cs-137 **(Wet)**	0.155	0.102	0.075
(pCi/g)	+/- 2 Sigma	0.024	0.021	0.021
	MDA	0.014	0.013	0.014
	Sr-89/90 **(Wet)**	Not Analyzed	0.089	Not Analyzed
	+/- 2 Sigma		0.007	
	MDC		0.004	
	Sr-89/90 **(Dry)**	Not Analyzed	0.371	Not Analyzed
	+/- 2 Sigma		0.031	
	MDC		0.017	

Sample Location		Steel Creek	Steel Creek
Sample Station		SV-2017	SV-2017
Sample Date		4/18/2007	4/18/2007
Sample Cut		Non-edible	Edible
Species		Catfish	Chain pickerel
	Tritium (pCi/L)	Not Analyzed	Not Analyzed
	+/- 2 Sigma		
	LLD		
Tritium (pCi)/gram of water in tissue			
Radionuclides	Cs-137 **(Wet)**	Non-detect	0.071
(pCi/g)	+/- 2 Sigma		0.018
	MDA	0.016	0.017
	Sr-89/90 **(Wet)**	0.003	0.006
	+/- 2 Sigma	0.002	0.003
	MDC	0.003	0.005
	Sr-89/90 **(Dry)**	0.013	0.029
	+/- 2 Sigma	0.007	0.014
	MDC	0.012	0.024

1. Tritium results (pCi/L) represent the activity level in the water distilled from the fish tissue
2. Cs-137 results represent the activity level in actual fish tissue
3. Strontium results represent the activity level in an aliquot of fish tissue
4. Non-detect denotes <LLD or <MDA or <MDC

Radiological Monitoring of Fish
Radionuclides Data

Sample Location		Lower Three Runs	Lower Three Runs	Lower Three Runs
Sample Station		SV-2020	SV-2020	SV-2020
Sample Date		4/20/2007	4/20/2007	4/20/2007
Sample Cut		Edible	Non-edible	Edible
Species		Bass	Bass	Catfish
	Tritium (pCi/L)	518	Not Analyzed	484
	+/- 2 Sigma	103		101
	LLD	196		196
Tritium (pCi)/gram of water in tissue		0.518		0.484
Radionuclides	Cs-137 **(Wet)**	0.473	0.303	0.053
(pCi/g)	+/- 2 Sigma	0.046	0.035	0.012
	MDA	0.010	0.010	0.010
	Sr-89/90 **(Wet)**	Not Analyzed	0.085	Not Analyzed
	+/- 2 Sigma		0.007	
	MDC		0.005	
	Sr-89/90 **(Dry)**	Not Analyzed	0.308	Not Analyzed
	+/- 2 Sigma		0.026	
	MDC		0.017	

Sample Location		Lower Three Runs	Lower Three Runs
Sample Station		SV-2020	SV-2020
Sample Date		4/20/2007	5/30/2007
Sample Cut		Non-edible	Edible
Species		Catfish	Chain pickerel
	Tritium (pCi/L)	Not Analyzed	Not Analyzed
	+/- 2 Sigma		
	LLD		
Tritium (pCi)/gram of water in tissue			
Radionuclides	Cs-137 **(Wet)**	0.039	0.102
(pCi/g)	+/- 2 Sigma	0.011	0.039
	MDA	0.009	0.033
	Sr-89/90 **(Wet)**	0.074	Not Analyzed
	+/- 2 Sigma	0.007	
	MDC	0.005	
	Sr-89/90 **(Dry)**	0.224	Not Analyzed
	+/- 2 Sigma	0.021	
	MDC	0.016	

1. Tritium results (pCi/L) represent the activity level in the water distilled from the fish tissue
2. Cs-137 results represent the activity level in actual fish tissue
3. Strontium results represent the activity level in an aliquot of fish tissue
4. Non-detect denotes <LLD or <MDA or <MDC

Radiological Monitoring of Fish
Radionuclides Data

Sample Location		Hwy. 301	Hwy. 301	Hwy. 301
Sample Station		SV-118	SV-118	SV-118
Sample Date		4/24/2007	4/24/2007	4/24/2007
Sample Cut		Edible	Non-edible	Edible
Species		Bass	Bass	Catfish
	Tritium (pCi/L)	396	Not Analyzed	621
	+/- 2 Sigma	100		106
	LLD	196		196
Tritium (pCi)/gram of water in tissue		0.396		0.621
Radionuclides	Cs-137 **(Wet)**	0.027	0.026	Non-detect
(pCi/g)	+/- 2 Sigma	0.010	0.010	
	MDA	0.009	0.011	0.011
	Sr-89/90 **(Wet)**	Not Analyzed	0.123	Not Analyzed
	+/- 2 Sigma		0.011	
	MDC		0.008	
	Sr-89/90 **(Dry)**	Not Analyzed	0.466	Not Analyzed
	+/- 2 Sigma		0.040	
	MDC		0.029	

Sample Location		Hwy. 301	Hwy. 301	Hwy. 301 - Ind.
Sample Station		SV-118	SV-118	SV-118
Sample Date		4/24/2007	4/24/2007	4/24/2007
Sample Cut		Non-edible	Edible	Edible
Species		Catfish	Chain pickerel	Bass
	Tritium (pCi/L)	Not Analyzed	Not Analyzed	345
	+/- 2 Sigma			96
	LLD			196
Tritium (pCi)/gram of water in tissue				0.345
Radionuclides	Cs-137 **(Wet)**	Non-detect	0.025	0.020
(pCi/g)	+/- 2 Sigma		0.013	0.009
	MDA	0.010	0.013	0.011
	Sr-89/90 **(Wet)**	0.103	Not Analyzed	Not Analyzed
	+/- 2 Sigma	0.009		
	MDC	0.005		
	Sr-89/90 **(Dry)**	0.360	Not Analyzed	Not Analyzed
	+/- 2 Sigma	0.030		
	MDC	0.017		

1. Tritium results (pCi/L) represent the activity level in the water distilled from the fish tissue
2. Cs-137 results represent the activity level in actual fish tissue
3. Strontium results represent the activity level in an aliquot of fish tissue
4. Non-detect denotes <LLD or <MDA or <MDC

Radiological Monitoring of Fish
Radionuclides Data

Sample Location		Stokes Bluff	Stokes Bluff	Stokes Bluff
Sample Station		SV-355	SV-355	SV-355
Sample Date		4/27/2007	4/27/2007	4/27/2007
Sample Cut		Edible	Non-edible	Edible
Species		Bass	Bass	Catfish
	Tritium (pCi/L)	477	Not Analyzed	396
	+/- 2 Sigma	94		91
	LLD	175		175
Tritium (pCi)/gram of water in tissue		0.477		0.396
Radionuclides	Cs-137 **(Wet)**	0.045	Non-detect	0.028
(pCi/g)	+/- 2 Sigma	0.013		0.012
	MDA	0.011	0.009	0.009
	Sr-89/90 **(Wet)**	Not Analyzed	0.134	Not Analyzed
	+/- 2 Sigma		0.011	
	MDC		0.005	
	Sr-89/90 **(Dry)**	Not Analyzed	0.507	Not Analyzed
	+/- 2 Sigma		0.040	
	MDC		0.017	

Sample Location		Stokes Bluff
Sample Station		SV-355
Sample Date		4/27/2007
Sample Cut		Non-edible
Species		Catfish
	Tritium (pCi/L)	Not Analyzed
	+/- 2 Sigma	
	LLD	
Tritium (pCi)/gram of water in tissue		
Radionuclides	Cs-137 **(Wet)**	Non-detect
(pCi/g)	+/- 2 Sigma	
	MDA	0.013
	Sr-89/90 **(Wet)**	0.059
	+/- 2 Sigma	0.006
	MDC	0.005
	Sr-89/90 **(Dry)**	0.218
	+/- 2 Sigma	0.021
	MDC	0.018

1. Tritium results (pCi/L) represent the activity level in the water distilled from the fish tissue
2. Cs-137 results represent the activity level in actual fish tissue
3. Strontium results represent the activity level in an aliquot of fish tissue
4. Non-detect denotes <LLD or <MDA or <MDC

Radiological Monitoring of Fish
Radionuclides Data

Sample Location		Hwy. 17 - Fresh	Hwy. 17 - Fresh	Hwy. 17 - Fresh
Sample Station		SV-2090	SV-2090	SV-2090
Sample Date		5/29/2007	5/29/2007	5/29/2007
Sample Cut		Edible	Non-edible	Edible
Species		Bass	Bass	Catfish
	Tritium (pCi/L)	Non-detect	Not Analyzed	273
	+/- 2 Sigma			94
	LLD	196		196
Tritium (pCi)/gram of water in tissue				0.273
Radionuclides	Cs-137 **(Wet)**	0.031	Non-detect	0.035
(pCi/g)	+/- 2 Sigma	0.014		0.016
	MDA	0.017	0.015	0.019
	Sr-89/90 **(Wet)**	Not Analyzed	Not Analyzed	Not Analyzed
	+/- 2 Sigma			
	MDC			
	Sr-89/90 **(Dry)**	Not Analyzed	Not Analyzed	Not Analyzed
	+/- 2 Sigma			
	MDC			

Sample Location		Hwy. 17 - Fresh
Sample Station		SV-2090
Sample Date		5/29/2007
Sample Cut		Non-edible
Species		Catfish
	Tritium (pCi/L)	Not Analyzed
	+/- 2 Sigma	
	LLD	
Tritium (pCi)/gram of water in tissue		
Radionuclides	Cs-137 **(Wet)**	Non-detect
(pCi/g)	+/- 2 Sigma	
	MDA	0.017
	Sr-89/90 **(Wet)**	Not Analyzed
	+/- 2 Sigma	
	MDC	
	Sr-89/90 **(Dry)**	Not Analyzed
	+/- 2 Sigma	
	MDC	

1. Tritium results (pCi/L) represent the activity level in the water distilled from the fish tissue
2. Cs-137 results represent the activity level in actual fish tissue
3. Strontium results represent the activity level in an aliquot of fish tissue
4. Non-detect denotes <LLD or <MDA or <MDC

Radiological Monitoring of Fish
Radionuclides Data

Sample Location		Hwy. 17 - Salt	Hwy. 17 - Salt	Hwy. 17 - Salt
Sample Station		SV-2091	SV-2091	SV-2091
Sample Date		10/9/2007	10/2/2007	10/2/2007
Sample Cut		Edible	Edible	Edible
Species		Red drum	Spotted seatrout	Striped mullet
Tritium (pCi)/gram of water in tissue	Tritium (pCi/L)	Non-detect	Non-detect	Non-detect
	+/- 2 Sigma			
	LLD	196	196	196
Radionuclides (pCi/g)	Cs-137 **(Wet)**	Non-detect	Non-detect	Non-detect
	+/- 2 Sigma			
	MDA	0.016	0.018	0.018
	Sr-89/90 **(Wet)**	Not Analyzed	Not Analyzed	Not Analyzed
	+/- 2 Sigma			
	MDC			
	Sr-89/90 **(Dry)**	Not Analyzed	Not Analyzed	Not Analyzed
	+/- 2 Sigma			
	MDC			

Sample Location		Hwy. 17 - Salt
Sample Station		SV-2091
Sample Date		10/9/2007
Sample Cut		Edible
Species		Shrimp
Tritium (pCi)/gram of water in tissue	Tritium (pCi/L)	Not Analyzed
	+/- 2 Sigma	
	LLD	
Radionuclides (pCi/g)	Cs-137 **(Wet)**	Non-detect
	+/- 2 Sigma	
	MDA	0.019
	Sr-89/90 **(Wet)**	Not Analyzed
	+/- 2 Sigma	
	MDC	
	Sr-89/90 **(Dry)**	Not Analyzed
	+/- 2 Sigma	
	MDC	

1. Tritium results (pCi/L) represent the activity level in the water distilled from the fish tissue
2. Cs-137 results represent the activity level in actual fish tissue
3. Strontium results represent the activity level in an aliquot of fish tissue
4. Non-detect denotes <LLD or <MDA or <MDC

Radiological Monitoring of Fish
Radionuclides Data

Sample Location		Stevens Creek	Stevens Creek	Stevens Creek
Sample Station		SV-2059	SV-2059	SV-2059
Sample Date		4/10/2007	4/10/2007	
Sample Cut		Edible	Non-edible	Edible
Species		Bass	Bass	Catfish
Radionuclides (pCi/g - Wet)	K-40	2.855	2.598	None collected
	+/- 2 Sigma	0.356	0.340	
	MDA	0.099	0.116	
	Co-60	Non-detect	Non-detect	None collected
	+/- 2 Sigma			
	MDA	0.014	0.015	
	Am-241	Non-detect	Non-detect	None collected
	+/- 2 Sigma			
	MDA	0.191	0.218	

Sample Location		Stevens Creek
Sample Station		SV-2059
Sample Date		
Sample Cut		Non-edible
Species		Catfish
Radionuclides (pCi/g - Wet)	K-40	None collected
	+/- 2 Sigma	
	MDA	
	Co-60	None collected
	+/- 2 Sigma	
	MDA	
	Am-241	None collected
	+/- 2 Sigma	
	MDA	

1. Results represent the activity level in actual fish tissue
2. Non-detect denotes <MDA

Radiological Monitoring of Fish
Radionuclides Data

Sample Location		NSBLD	NSBLD	NSBLD
Sample Station		SV-2028	SV-2028	SV-2028
Sample Date		4/3/2007	4/3/2007	4/3/2007
Sample Cut		Edible	Non-edible	Edible
Species		Bass	Bass	Catfish
Radionuclides (pCi/g - Wet)	K-40	3.531	2.510	3.702
	+/- 2 Sigma	0.359	0.306	0.369
	MDA	0.126	0.111	0.125
	Co-60	Non-detect	Non-detect	Non-detect
	+/- 2 Sigma			
	MDA	0.015	0.015	0.014
	Am-241	Non-detect	Non-detect	Non-detect
	+/- 2 Sigma			
	MDA	0.097	0.097	0.096

Sample Location		NSBLD
Sample Station		SV-2028
Sample Date		4/3/2007
Sample Cut		Non-edible
Species		Catfish
Radionuclides (pCi/g - Wet)	K-40	2.387
	+/- 2 Sigma	0.278
	MDA	0.113
	Co-60	Non-detect
	+/- 2 Sigma	
	MDA	0.014
	Am-241	Non-detect
	+/- 2 Sigma	
	MDA	0.100
	Pb-214	0.074
	+/- 2 Sigma	0.031
	MDA	0.029

1. Results represent the activity level in actual fish tissue
2. Non-detect denotes <MDA

Radiological Monitoring of Fish
Radionuclides Data

Sample Location		Upper Three Runs	Upper Three Runs	Upper Three Runs
Sample Station		SV-2011	SV-2011	SV-2011
Sample Date		4/5/2007	4/5/2007	4/5/2007
Sample Cut		Edible	Non-edible	Edible
Species		Bass	Bass	Catfish
Radionuclides	K-40	3.494	2.215	3.110
(pCi/g - Wet)	+/- 2 Sigma	0.411	0.322	0.397
	MDA	0.112	0.121	0.105
	Co-60	Non-detect	Non-detect	Non-detect
	+/- 2 Sigma			
	MDA	0.015	0.010	0.013
	Am-241	Non-detect	Non-detect	Non-detect
	+/- 2 Sigma			
	MDA	0.221	0.210	0.216
	Pb-214	0.060	Non-detect	Non-detect
	+/- 2 Sigma	0.028		
	MDA	0.030	0.030	0.040

Sample Location		Upper Three Runs
Sample Station		SV-2011
Sample Date		4/5/2007
Sample Cut		Non-edible
Species		Catfish
Radionuclides	K-40	2.047
(pCi/g - Wet)	+/- 2 Sigma	0.307
	MDA	0.120
	Co-60	Non-detect
	+/- 2 Sigma	
	MDA	0.015
	Am-241	Non-detect
	+/- 2 Sigma	
	MDA	0.205
	Pb-214	0.082
	+/- 2 Sigma	0.029
	MDA	0.030

1. Results represent the activity level in actual fish tissue
2. Non-detect denotes <MDA

Radiological Monitoring of Fish
Radionuclides Data

Sample Location		Beaver Dam Creek	Beaver Dam Creek	Beaver Dam Creek
Sample Station		SV-2013	SV-2013	SV-2013
Sample Date		4/12/2007	4/12/2007	4/12/2007
Sample Cut		Edible	Non-edible	Edible
Species		Bass	Bass	Catfish
Radionuclides (pCi/g - Wet)	K-40	3.422	1.866	3.467
	+/- 2 Sigma	0.442	0.324	0.431
	MDA	0.146	0.116	0.154
	Co-60	Non-detect	Non-detect	Non-detect
	+/- 2 Sigma			
	MDA	0.018	0.013	0.166
	Am-241	Non-detect	Non-detect	Non-detect
	+/- 2 Sigma			
	MDA	0.235	0.219	0.238
	Pb-214	Non-detect	Non-detect	0.060
	+/- 2 Sigma			0.028
	MDA	0.041	0.036	0.036

Sample Location		Beaver Dam Creek	Beaver Dam Creek
Sample Station		SV-2013	SV-2013
Sample Date		4/12/2007	4/12/2007
Sample Cut		Non-edible	Edible
Species		Catfish	Chain pickerel
Radionuclides (pCi/g - Wet)	K-40	2.233	3.279
	+/- 2 Sigma	0.331	0.436
	MDA	0.109	0.126
	Co-60	Non-detect	Non-detect
	+/- 2 Sigma		
	MDA	0.017	0.016
	Am-241	Non-detect	Non-detect
	+/- 2 Sigma		
	MDA	0.203	0.236
	Pb-214	0.078	Non-detect
	+/- 2 Sigma	0.026	
	MDA	0.031	0.045

1. Results represent the activity level in actual fish tissue
2. Non-detect denotes <MDA

Radiological Monitoring of Fish
Radionuclides Data

Sample Location		Fourmile Creek	Fourmile Creek	Fourmile Creek
Sample Station		SV-2015	SV-2015	SV-2015
Sample Date		4/13/2007	4/13/2007	4/13/2007
Sample Cut		Edible	Non-edible	Edible
Species		Bass	Bass	Catfish
Radionuclides (pCi/g - Wet)	K-40	3.053	2.086	2.775
	+/- 2 Sigma	0.385	0.340	0.346
	MDA	0.127	0.111	0.093
	Co-60	Non-detect	Non-detect	Non-detect
	+/- 2 Sigma			
	MDA	0.013	0.017	0.015
	Am-241	Non-detect	Non-detect	Non-detect
	+/- 2 Sigma			
	MDA	0.200	0.235	0.205
	Pb-214	Non-detect	0.089	Non-detect
	+/- 2 Sigma		0.030	
	MDA	0.034	0.034	0.039

Sample Location		Fourmile Creek
Sample Station		SV-2015
Sample Date		4/13/2007
Sample Cut		Non-edible
Species		Catfish
Radionuclides (pCi/g - Wet)	K-40	2.048
	+/- 2 Sigma	0.317
	MDA	0.130
	Co-60	Non-detect
	+/- 2 Sigma	
	MDA	0.014
	Am-241	Non-detect
	+/- 2 Sigma	
	MDA	0.207

1. Results represent the activity level in actual fish tissue
2. Non-detect denotes <MDA

Radiological Monitoring of Fish
Radionuclides Data

Sample Location		Steel Creek	Steel Creek	Steel Creek
Sample Station		SV-2017	SV-2017	SV-2017
Sample Date		5/16/2007	5/16/2007	4/18/2007
Sample Cut		Edible	Non-edible	Edible
Species		Bass	Bass	Catfish
Radionuclides (pCi/g - Wet)	K-40	3.227	2.270	2.827
	+/- 2 Sigma	0.333	0.295	0.303
	MDA	0.118	0.128	0.117
	Co-60	Non-detect	Non-detect	Non-detect
	+/- 2 Sigma			
	MDA	0.015	0.015	0.016
	Am-241	Non-detect	Non-detect	Non-detect
	+/- 2 Sigma			
	MDA	0.092	0.100	0.086

Sample Location		Steel Creek	Steel Creek
Sample Station		SV-2017	SV-2017
Sample Date		4/18/2007	4/18/2007
Sample Cut		Non-edible	Edible
Species		Catfish	Chain pickerel
Radionuclides (pCi/g - Wet)	K-40	1.880	3.792
	+/- 2 Sigma	0.300	0.425
	MDA	0.133	0.157
	Co-60	Non-detect	Non-detect
	+/- 2 Sigma		
	MDA	0.015	0.020
	Am-241	Non-detect	Non-detect
	+/- 2 Sigma		
	MDA	0.098	0.124

1. Results represent the activity level in actual fish tissue
2. Non-detect denotes <MDA

Radiological Monitoring of Fish
Radionuclides Data

Sample Station		SV-2020	SV-2020	SV-2020
Sample Date		4/20/2007	4/20/2007	4/20/2007
Sample Cut		Edible	Non-edible	Edible
Species		Bass	Bass	Catfish
Radionuclides (pCi/g - Wet)	K-40	3.338	2.176	3.354
	+/- 2 Sigma	0.349	0.287	0.366
	MDA	0.095	0.093	0.098
	Co-60	Non-detect	Non-detect	Non-detect
	+/- 2 Sigma			
	MDA	0.011	0.012	0.010
	Am-241	Non-detect	Non-detect	Non-detect
	+/- 2 Sigma			
	MDA	0.064	0.069	0.066

Sample Location		Lower Three Runs	Lower Three Runs
Sample Station		SV-2020	SV-2020
Sample Date		4/20/2007	5/30/2007
Sample Cut		Non-edible	Edible
Species		Catfish	Chain pickerel
Radionuclides (pCi/g - Wet)	K-40	1.794	4.169
	+/- 2 Sigma	0.237	0.664
	MDA	0.088	0.285
	Co-60	Non-detect	Non-detect
	+/- 2 Sigma		
	MDA	0.011	0.031
	Am-241	Non-detect	Non-detect
	+/- 2 Sigma		
	MDA	0.065	0.436
	Pb-214	Non-detect	0.140
	+/- 2 Sigma		0.061
	MDA	0.030	0.066

1. Results represent the activity level in actual fish tissue
2. Non-detect denotes <MDA

Radiological Monitoring of Fish
Radionuclides Data

Sample Location		Hwy. 301	Hwy. 301	Hwy. 301
Sample Station		SV-118	SV-118	SV-118
Sample Date		4/24/2007	4/24/2007	4/24/2007
Sample Cut		Edible	Non-edible	Edible
Species		Bass	Bass	Catfish
Radionuclides (pCi/g - Wet)	K-40	3.112	2.194	2.810
	+/- 2 Sigma	0.327	0.298	0.338
	MDA	0.091	0.101	0.087
	Co-60	Non-detect	Non-detect	Non-detect
	+/- 2 Sigma			
	MDA	0.011	0.010	0.012
	Am-241	Non-detect	Non-detect	Non-detect
	+/- 2 Sigma			
	MDA	0.061	0.063	0.062
	Pb-214	Non-detect	0.038	Non-detect
	+/- 2 Sigma		0.017	
	MDA	0.022	0.021	0.027

Sample Location		Hwy. 301	Hwy. 301	Hwy. 301 - Ind.
Sample Station		SV-118	SV-118	SV-118
Sample Date		4/24/2007	4/24/2007	4/24/2007
Sample Cut		Non-edible	Edible	Edible
Species		Catfish	Chain pickerel	Bass
Radionuclides (pCi/g - Wet)	K-40	2.006	3.575	3.369
	+/- 2 Sigma	0.271	0.394	0.377
	MDA	0.104	0.105	0.090
	Co-60	Non-detect	Non-detect	Non-detect
	+/- 2 Sigma			
	MDA	0.010	0.013	0.012
	Am-241	Non-detect	Non-detect	Non-detect
	+/- 2 Sigma			
	MDA	0.062	0.072	0.061

1. Results represent the activity level in actual fish tissue
2. Non-detect denotes <MDA

Radiological Monitoring of Fish
Radionuclides Data

Sample Location		Stokes Bluff	Stokes Bluff	Stokes Bluff
Sample Station		SV-355	SV-355	SV-355
Sample Date		4/27/2007	4/27/2007	4/27/2007
Sample Cut		Edible	Non-edible	Edible
Species		Bass	Bass	Catfish
Radionuclides (pCi/g - Wet)	K-40	3.533	2.170	3.221
	+/- 2 Sigma	0.374	0.259	0.340
	MDA	0.089	0.084	0.105
	Co-60	Non-detect	Non-detect	Non-detect
	+/- 2 Sigma			
	MDA	0.011	0.010	0.012
	Am-241	Non-detect	Non-detect	Non-detect
	+/- 2 Sigma			
	MDA	0.066	0.063	0.062

Sample Location		Stokes Bluff
Sample Station		SV-355
Sample Date		4/27/2007
Sample Cut		Non-edible
Species		Catfish
Radionuclides (pCi/g - Wet)	K-40	1.868
	+/- 2 Sigma	0.234
	MDA	0.097
	Co-60	Non-detect
	+/- 2 Sigma	
	MDA	0.011
	Am-241	Non-detect
	+/- 2 Sigma	
	MDA	0.059

1. Results represent the activity level in actual fish tissue
2. Non-detect denotes <MDA

Radiological Monitoring of Fish
Radionuclides Data

Sample Location		Hwy. 17 - Fresh	Hwy. 17 - Fresh	Hwy. 17 - Fresh
Sample Station		SV-2090	SV-2090	SV-2090
Sample Date		5/29/2007	5/29/2007	5/29/2007
Sample Cut		Edible	Non-edible	Edible
Species		Bass	Bass	Catfish
Radionuclides (pCi/g - Wet)	K-40	3.238	2.052	3.121
	+/- 2 Sigma	0.428	0.327	0.421
	MDA	0.165	0.153	0.168
	Co-60	Non-detect	Non-detect	Non-detect
	+/- 2 Sigma			
	MDA	0.018	0.015	0.020
	Am-241	Non-detect	Non-detect	Non-detect
	+/- 2 Sigma			
	MDA	0.231	0.201	0.234

Sample Location		Hwy. 17 - Fresh
Sample Station		SV-2090
Sample Date		5/29/2007
Sample Cut		Non-edible
Species		Catfish
Radionuclides (pCi/g - Wet)	K-40	2.336
	+/- 2 Sigma	0.325
	MDA	0.125
	Co-60	Non-detect
	+/- 2 Sigma	
	MDA	0.015
	Am-241	Non-detect
	+/- 2 Sigma	
	MDA	0.198

1. Results represent the activity level in actual fish tissue
2. Non-detect denotes <MDA

Radiological Monitoring of Fish
Radionuclides Data

Sample Location		Hwy. 17 - Salt	Hwy. 17 - Salt	Hwy. 17 - Salt
Sample Station		SV-2091	SV-2091	SV-2091
Sample Date		10/9/2007	10/2/2007	10/2/2007
Sample Cut		Edible	Edible	Edible
Species		Red drum	Spotted seatrout	Striped mullet
Radionuclides	K-40	3.570	3.366	3.340
(pCi/g - Wet)	+/- 2 Sigma	0.431	0.456	0.411
	MDA	0.125	0.106	0.149
	Co-60	Non-detect	Non-detect	Non-detect
	+/- 2 Sigma			
	MDA	0.014	0.017	0.016
	Am-241	Non-detect	Non-detect	Non-detect
	+/- 2 Sigma			
	MDA	0.206	0.210	0.217
	Pb-214	Non-detect	Non-detect	0.185
	+/- 2 Sigma			0.039
	MDA	0.040	0.038	0.031

Sample Location		Hwy. 17 - Salt
Sample Station		SV-2091
Sample Date		10/9/2007
Sample Cut		Edible
Species		Shrimp
Radionuclides	K-40	3.398
(pCi/g - Wet)	+/- 2 Sigma	0.453
	MDA	0.166
	Co-60	Non-detect
	+/- 2 Sigma	
	MDA	0.017
	Am-241	Non-detect
	+/- 2 Sigma	
	MDA	0.256

1. Results represent the activity level in actual fish tissue
2. Non-detect denotes <MDA

Radiological Monitoring of Fish
ESOP Historical Data, 2003-2007

Year	Sample Location		Stevens	NSBLD	UTR	BDC	FMC	STC	LTR	Hwy. 301	Stokes	Hwy. 17
	Sample Station		SV-2059	SV-2028	SV-2011	SV-2013	SV-2015	SV-2017	SV-2020	SV-118	SV-355	SV-2090
	Sample Cut		Edible	Edible	Edible	Edible	Edible	Edible	Edible	Edible	Edible	Edible
	Species		Bass	Bass	Bass	Bass	Bass	Bass	Bass	Bass	Bass	Bass
2007	Radionuclide	Tritium (pCi/L)	ND	ND	ND	359	2,930	183	518	396	477	ND
2006			504	269	385	232	2,920	2,287	474	454	265	368
2005			ND	ND	ND	ND	2,572	836	403	257	ND	NS
2004			ND	ND	ND	ND	2,865	3,442	526	2,425	227	NS
2003			ND	ND	292	292	2,621	888	666	705	508	NS
2007	Radionuclide	Cs-137 (pCi/g wet)	ND	ND	0.129	0.117	0.052	0.155	0.473	0.027	0.045	0.031
2006			ND	ND	ND	0.069	0.206	0.198	0.391	ND	0.039	ND
2005			ND	ND	0.144	0.096	0.547	0.182	0.182	0.053	ND	NS
2004			ND	ND	0.061	0.076	0.086	0.225	0.566	ND	0.056	NS
2003			ND	0.053	0.043	0.051	0.367	0.152	0.056	0.071	0.056	NS

Year	Sample Location		Stevens	NSBLD	UTR	BDC	FMC	STC	LTR	Hwy. 301	Stokes	Hwy. 17
	Sample Station		SV-2059	SV-2028	SV-2011	SV-2013	SV-2015	SV-2017	SV-2020	SV-118	SV-355	SV-2090
	Sample Cut		Non-Edible	Non-Edible	Non-Edible	Non-Edible	Non-Edible	Non-Edible	Non-Edible	Non-Edible	Non-Edible	Non-Edible
	Species		Bass	Bass	Bass	Bass	Bass	Bass	Bass	Bass	Bass	Bass
2007	Radionuclide	Cs-137 (pCi/g wet)	ND	ND	0.057	0.079	ND	0.102	0.303	0.026	ND	ND
2006			ND	ND	ND	ND	0.107	0.081	0.192	ND	ND	ND
2005			ND	ND	0.084	0.042	0.314	0.113	0.122	ND	ND	NS
2004			ND	ND	ND	0.044	0.058	0.171	0.284	ND	ND	NS
2003			ND	ND	ND	0.028	0.160	0.113	0.033	ND	ND	NS
2007	Radionuclide	Sr-89,90 (pCi/g **dry**)	0.449	0.306	0.550	0.705	0.661	0.371	0.308	0.466	0.507	NA
2006			0.507	0.229	0.603	0.277	0.116	0.248	0.196	0.258	0.296	0.357
2005			0.127	0.100	0.078	0.493	0.442	0.300	0.313	0.400	0.752	NS
2004			0.196	0.156	0.117	0.099	0.249	0.166	0.087	0.079	ND	NS
2003			NA	0.147	0.124	0.156	1.350	0.101	0.158	ND	0.305	NS

Year	Sample Location		Stevens	NSBLD	UTR	BDC	FMC	STC	LTR	Hwy. 301	Stokes	Hwy. 17
	Sample Station		SV-2059	SV-2028	SV-2011	SV-2013	SV-2015	SV-2017	SV-2020	SV-118	SV-355	SV-2090
	Sample Cut		Edible	Edible	Edible	Edible	Edible	Edible	Edible	Edible	Edible	Edible
	Species		Catfish	Catfish	Catfish	Catfish	Catfish	Catfish	Catfish	Catfish	Catfish	Catfish
2007	Radionuclide	Tritium (pCi/L)	NS	ND	ND	233	2,010	1,120	484	621	396	273
2006			397	302	ND	469	1,779	2,104	451	423	296	ND
2005			ND	ND	ND	ND	669	340	362	ND	ND	NS
2004			ND	ND	377	282	3,761	295	315	2042	228	NS
2003			ND	209	ND	277	388	583	537	ND	354	NS
2007	Radionuclide	Cs-137 (pCi/g wet)	NS	0.041	ND	ND	0.342	0.075	0.053	ND	0.028	0.035
2006			ND	ND	ND	ND	0.043	0.101	0.135	ND	ND	0.035
2005			ND	ND	ND	ND	ND	0.143	0.140	ND	ND	NS
2004			ND	ND	ND	ND	0.316	0.071	0.111	ND	ND	NS
2003			ND	ND	ND	0.041	0.052	0.114	0.088	0.043	ND	NS

Year	Sample Location		Stevens	NSBLD	UTR	BDC	FMC	STC	LTR	Hwy. 301	Stokes	Hwy. 17
	Sample Station		SV-2059	SV-2028	SV-2011	SV-2013	SV-2015	SV-2017	SV-2020	SV-118	SV-355	SV-2090
	Sample Cut		Non-Edible	Non-Edible	Non-Edible	Non-Edible	Non-Edible	Non-Edible	Non-Edible	Non-Edible	Non-Edible	Non-Edible
	Species		Catfish	Catfish	Catfish	Catfish	Catfish	Catfish	Catfish	Catfish	Catfish	Catfish
2007	Radionuclide	Cs-137 (pCi/g wet)	NS	ND	ND	0.028	0.178	ND	0.039	ND	ND	ND
2006			ND	ND	ND	ND	0.051	0.045	0.088	ND	ND	ND
2005			ND	ND	ND	ND	0.028	0.078	0.082	ND	ND	NS
2004			ND	ND	ND	ND	0.167	ND	0.205	ND	ND	NS
2003			ND	ND	ND	ND	0.047	0.085	0.050	ND	ND	NS
2007	Radionuclide	Sr-90 (pCi/g **dry**)	NS	0.306	0.225	0.433	0.200	0.013	0.224	0.360	0.218	NA
2006			0.247	0.208	0.234	0.234	0.213	0.329	0.266	0.168	0.165	0.166
2005			0.426	ND	0.064	0.080	0.364	0.262	0.186	0.606	0.302	NS
2004			NA	0.069	0.079	0.129	0.127	ND	ND	0.082	0.063	NS
2003			NA	0.302	0.098	0.173	0.320	ND	0.085	ND	ND	NS

Notes: ND - Non-Detect
NA - Not Analyzed
NS - Not Sampled

Radiological Monitoring of Fish
ESOP and DOE-SR Data Comparison

Table 1
Tritium Activity Levels in Edible Bass
pCi/g[1]

Location	Agency	# of samples	Result
NSBLD	ESOP	1	<LLD
	DOE-SR	3	<MDC
Upper Three Runs	ESOP	1	<LLD
	DOE-SR	3	<MDC
Beaver Dam Creek	ESOP	1	0.36
	DOE-SR	3	<MDC
Fourmile Creek	ESOP	1	2.93
	DOE-SR	3	<MDC
Steel Creek	ESOP	1	0.18
	DOE-SR	3	<MDC
Lower Three Runs	ESOP	1	0.52
	DOE-SR	3	<MDC
Hwy. 301	ESOP	1	0.40
	DOE-SR	3	<MDC
Stokes Bluff	ESOP	1	0.48
	DOE-SR	3	<MDC
Hwy. 17	ESOP	1	<LLD
	DOE-SR	3	<MDC
Average[2]	ESOP	6	0.81
	DOE-SR	0	N/A
Standard Deviation[2]	ESOP	6	1.05
	DOE-SR	0	N/A

Table 2
Tritium Activity Levels in Edible Catfish
pCi/g[1]

Location	Agency	# of samples	Result
NSBLD	ESOP	1	<LLD
	DOE-SR	3	<MDC
Upper Three Runs	ESOP	1	<LLD
	DOE-SR	3	<MDC
Beaver Dam Creek	ESOP	1	0.23
	DOE-SR	3	<MDC
Fourmile Creek	ESOP	1	2.01
	DOE-SR	3	<MDC
Steel Creek	ESOP	1	1.12
	DOE-SR	3	0.08*
Lower Three Runs	ESOP	1	0.48
	DOE-SR	3	<MDC
Hwy. 301	ESOP	1	0.62
	DOE-SR	3	<MDC
Stokes Bluff	ESOP	1	0.40
	DOE-SR	3	<MDC
Hwy. 17	ESOP	1	0.27
	DOE-SR	3	0.09**
Average[2]	ESOP	7	0.73
	DOE-SR	3	0.11
Standard Deviation[2]	ESOP	7	0.64
	DOE-SR	3	0.02

Notes:
[1]ESOP - per gram of water in fish tissue
DOE-SR data from WSRC 2008
DOE-SR results are averages
* includes one result below MDC
** includes two results below MDC
[2]Calculated using detections only
N/A - Not Applicable

Radiological Monitoring of Fish
ESOP and DOE-SR Data Comparison

Table 3
Cesium-137 Activity Levels in Edible Bass
pCi/g

Location	Agency	# of samples	Result
NSBLD	ESOP	1	<MDA
	DOE-SR	3	0.02**
Upper Three Runs	ESOP	1	0.13
	DOE-SR	3	0.04**
Beaver Dam Creek	ESOP	1	0.12
	DOE-SR	3	0.09
Fourmile Creek	ESOP	1	0.05
	DOE-SR	3	0.08**
Steel Creek	ESOP	1	0.16
	DOE-SR	3	0.19
Lower Three Runs	ESOP	1	0.47
	DOE-SR	3	0.23
Hwy. 301	ESOP	1	0.03
	DOE-SR	3	0.02
Stokes Bluff	ESOP	1	0.05
	DOE-SR	3	<MDC
Hwy. 17	ESOP	1	0.03
	DOE-SR	3	<MDC
Average [1]	ESOP	8	0.13
	DOE-SR	15	0.12
Standard Deviation [1]	ESOP	8	0.15
	DOE-SR	15	0.08

Table 4
Cesium-137 Activity Levels in Edible Catfish
pCi/g

Location	Agency	# of samples	Result
NSBLD	ESOP	1	0.04
	DOE-SR	3	<MDC
Upper Three Runs	ESOP	1	<MDA
	DOE-SR	3	<MDC
Beaver Dam Creek	ESOP	1	<MDA
	DOE-SR	3	0.03**
Fourmile Creek	ESOP	1	0.34
	DOE-SR	3	<MDC
Steel Creek	ESOP	1	0.08
	DOE-SR	3	0.04**
Lower Three Runs	ESOP	1	0.05
	DOE-SR	3	0.06
Hwy. 301	ESOP	1	<MDA
	DOE-SR	3	0.02*
Stokes Bluff	ESOP	1	0.03
	DOE-SR	3	<MDC
Hwy. 17	ESOP	1	0.04
	DOE-SR	3	
Average [1]	ESOP	6	0.10
	DOE-SR	7	0.04
Standard Deviation [1]	ESOP	6	0.12
	DOE-SR	7	0.02

Notes: DOE-SR data from WSRC 2008
DOE-SR results are averages
* includes one result below MDC
** includes two results below MDC
[1]calculated using detections only

Radiological Monitoring of Fish
ESOP and DOE-SR Data Comparison

Table 5
Cesium-137 Activity Levels in Non-edible Bass
pCi/g

Location	Agency	# of samples	Result
NSBLD	ESOP	1	<MDA
	DOE-SR	3	<MDC
Upper Three Runs	ESOP	1	0.06
	DOE-SR	3	0.05*
Beaver Dam Creek	ESOP	1	0.08
	DOE-SR	3	0.06
Fourmile Creek	ESOP	1	<MDA
	DOE-SR	3	0.05**
Steel Creek	ESOP	1	0.10
	DOE-SR	3	0.14
Lower Three Runs	ESOP	1	0.30
	DOE-SR	3	0.12
Hwy. 301	ESOP	1	0.03
	DOE-SR	3	0.02
Stokes Bluff	ESOP	1	<MDA
	DOE-SR	3	<MDA
Hwy. 17	ESOP	1	<MDA
	DOE-SR	3	<MDC
Average [1]	ESOP	5	0.11
	DOE-SR	15	0.08
Standard Deviation [1]	ESOP	5	0.11
	DOE-SR	15	0.05

Table 6
Cesium-137 Activity Levels in Non-edible Catfish
pCi/g

Location	Agency	# of samples	Result
NSBLD	ESOP	1	<MDA
	DOE-SR	3	<MDC
Upper Three Runs	ESOP	1	<MDA
	DOE-SR	3	<MDC
Beaver Dam Creek	ESOP	1	0.03
	DOE-SR	3	<MDC
Fourmile Creek	ESOP	1	0.18
	DOE-SR	3	<MDC
Steel Creek	ESOP	1	<MDA
	DOE-SR	3	0.03**
Lower Three Runs	ESOP	1	0.04
	DOE-SR	3	0.05*
Hwy. 301	ESOP	1	<MDA
	DOE-SR	3	<MDC
Stokes Bluff	ESOP	1	<MDA
	DOE-SR	3	<MDA
Hwy. 17	ESOP	1	<MDA
	DOE-SR	3	<MDC
Average [1]	ESOP	3	0.08
	DOE-SR	3	0.05
Standard Deviation [1]	ESOP	3	0.08
	DOE-SR	3	0.01

Notes: DOE-SR data from WSRC 2008
DOE-SR results are averages
* includes one result below MDC
** includes two results below MDC
[1]Calculated using detections only

Radiological Monitoring of Fish
ESOP and DOE-SR Data Comparison

Back to List of Data Tables

Table 7
Strontium **-89,90** Activity Levels in Non-edible Bass
pCi/g

Location	Agency	# of samples	Result
NSBLD	ESOP	1	0.08
	DOE-SR	3	0.05
Upper Three Runs	ESOP	1	0.16
	DOE-SR	3	0.09
Beaver Dam Creek	ESOP	1	0.17
	DOE-SR	3	0.15
Fourmile Creek	ESOP	1	0.17
	DOE-SR	3	0.07
Steel Creek	ESOP	1	0.09
	DOE-SR	3	0.05
Lower Three Runs	ESOP	1	0.09
	DOE-SR	3	0.12
Hwy. 301	ESOP	1	0.12
	DOE-SR	3	0.07
Stokes Bluff	ESOP	1	0.13
	DOE-SR	3	0.06
Hwy. 17	ESOP	1	NA
	DOE-SR	3	0.06
Average [1]	ESOP	9	0.13
	DOE-SR	27	0.08
Standard Deviation [1]	ESOP	9	0.04
	DOE-SR	27	0.04

Table 8
Strontium **-89,90** Activity Levels in Non-edible Catfish
pCi/g

Location	Agency	# of samples	Result
NSBLD	ESOP	1	0.08
	DOE-SR	3	0.04
Upper Three Runs	ESOP	1	0.05
	DOE-SR	3	0.06
Beaver Dam Creek	ESOP	1	0.11
	DOE-SR	3	0.04
Fourmile Creek	ESOP	1	0.05
	DOE-SR	3	0.06
Steel Creek	ESOP	1	0.00
	DOE-SR	3	0.09
Lower Three Runs	ESOP	1	0.07
	DOE-SR	3	0.08
Hwy. 301	ESOP	1	0.10
	DOE-SR	3	0.05
Stokes Bluff	ESOP	1	0.06
	DOE-SR	3	0.05
Hwy. 17	ESOP	1	NA
	DOE-SR	3	0.04
Average [1]	ESOP	9	0.07
	DOE-SR	27	0.06
Standard Deviation [1]	ESOP	9	0.03
	DOE-SR	27	0.02

Notes:
DOE-SR data from WSRC 2008
DOE-SR results are averages
* includes one result below MDC
** includes two results below MDC
[1]Calculated using detections only
NA - Not Analyzed

4.1.5 Summary Statistics

Radiological Monitoring of Fish

Summary Statistics.....375

Back to List of Summary Statistics

Summary Statistics
Radiological Monitoring of Fish

Tritium levels (pCi/L) in Savannah River Fish, 2007

Species	N	Average	Standard Deviation	Median	Minimum Detect	Maximum Detect
Largemouth bass	6 (3)	811	1045	437	183	2930
Catfish	7 (2)	734	636	486	233	2010

Edible composites only
Non-detects ( ) excluded from computations
Stevens Creek excluded from computations
Pickerel samples were not analyzed for tritium

Cs-137 levels (pCi/g - Wet) in Savannah River Fish, 2007

Species	Composite Type	N	Average	Standard Deviation	Median	Minimum Detect	Maximum Detect
Largemouth bass	Edible	8 (1)	0.129	0.148	0.084	0.027	0.473
	Nonedible	5 (4)	0.113	0.110	0.079	0.026	0.303
Catfish	Edible	6 (3)	0.096	0.122	0.047	0.028	0.342
	Nonedible	3 (6)	0.082	0.084	0.039	0.028	0.178
Chain pickerel	Edible	3 (1)	0.066	0.039	0.071	0.025	0.102

Non-detects ( ) excluded from computations
Cs-137 not detected at Stevens Creek
Pickerel not collected from NSBLD, Upper Three Runs, Fourmile Creek, Stokes Bluff, and Hwy. 17

Sr-89,90 levels (pCi/g - Wet) in Savannah River Fish, 2007

Species	N	Average	Standard Deviation	Median	Minimum Detect	Maximum Detect
Largemouth bass	8 (0)	0.126	0.039	0.129	0.078	0.170
Catfish	8 (0)	0.066	0.034	0.067	0.003	0.109
Chain pickerel	2 (0)	0.018	0.016	0.018	0.006	0.030

Non-edible composites only for bass and catfish, edible samples for pickerel
Non-detects ( ) excluded from computations
Stevens Creek excluded from computations
Sr analysis not performed on Hwy. 17 samples

N - denotes number of samples
Tritium results(pCi/L) represent the activity level in the water distilled from the fish tissue.
Cs-137 results represent the activity level in natural fish tissue.
Strontium results represent the activity level in an aliquot of wet fish tissue (calculated).

Back to List of Summary Statistics

4.2 Radiological Game Animal Monitoring Adjacent to SRS

4.2.1 Summary

Since the initiation of nuclear testing, concern has grown over the accumulation of radionuclides in the environment. The Savannah River Site (SRS) has historically been a nuclear weapons material production, separation, and research facility located along the Savannah River within Aiken, Allendale, and Barnwell counties of South Carolina. The operation of production reactors, waste storage sites and other nuclear facilities at SRS has resulted in the release of cesium-137 (Cs-137) to the environment for the past 50 years. As part of the environmental monitoring program, the Department of Energy - Savannah River (DOE-SR) investigates a variety of mammalian species for the presence of contaminants. Of all of the mammalian species investigated, white-tailed deer and feral hogs have shown the highest potential for a human exposure pathway for Cs-137 (Haselow 1991).

The precise ranging behavior of individual deer and hogs on the SRS is unknown. White-tailed deer and feral hogs have access to a number of contaminated areas on the SRS; and, consequently, are a vector for the redistribution of contaminants, primarily Cs-137, to off-site locations. Consumption of these wildlife species can result in the transfer of contaminants to humans. Cs-137 is of concern because of its relatively long physical half-life of 30 years, and its availability to game animals and associated health risk to humans.

Cs-137 is readily incorporated into the human body because of its similarity to potassium-40 (K-40) in physiological processes (Davis 1963). Cs-137 concentrates in animal skeletal muscles, which are selectively consumed by hunters (Brisbin 1975). Cs-137 is an important radionuclide because of its relatively long physical half-life of 30 years and its associated health risks (Haselow 1991). Cs-137 emits both beta and gamma radiation, contributing to both internal and external radiation exposure, which may be associated with gastrointestinal, genetic, hemopoietic, and central nervous system damage (Bond 1965). Because of these concerns, Cs-137 will be the only isotope discussed in this report.

The Environmental Surveillance and Oversight Program (ESOP) of the South Carolina Department of Health and Environmental Control (SCDHEC) conducts independent non-regulatory oversight of game animal monitoring activities at the SRS. The game animal project addresses concerns of potentially contaminated white-tailed deer and feral hogs migrating off the SRS and can provide valuable information concerning the potential off-site exposure to Cs-137 by analyzing samples collected off-site. In 2007, SCDHEC analyzed muscle tissue for Cs-137 from 65 deer collected from area hunters via hunting clubs, plantations, and Crackerneck Wildlife Management Area within a five-mile study area adjacent to the SRS. Additionally, 20 tissue samples were collected and analyzed from a background location 120 miles northeast of the SRS. Cs-137 data ranged from less than the minimum detectable activity (MDA) to 3.30 picocuries per gram (pCi/g) for deer within the five-mile study area adjacent to the SRS. Cs-137 data ranged from 0.15 to 2.09 pCi/g for deer at the 120-mile background location. Sample size, location, and collection dates were dependent on the participating hunters. ESOP was not able to obtain any hog samples from hunters in 2007.

RESULTS AND DISCUSSION

Cs-137 and the naturally occurring isotopes K-40, lead 212, and lead 214 were the only isotopes detected in game samples collected in 2007. Naturally occurring isotopes will not be discussed in this report. Cs-137 concentrations from deer collected in the SRS perimeter study area are shown in Map 12, Section 4.2.2. Analytical results are listed under each zone in Section 4.2.4.

A total of 85 deer samples were collected. Sixty-five samples were collected within five miles of the SRS perimeter. Twenty deer background samples were collected 120 miles northeast of the SRS. ESOP compared Cs-137 activities to DOE-SR results.

Cs-137 activities from the 65 perimeter samples ranged from less than the MDA to 3.30 pCi/g, with an average of 0.62 (± 0.61) pCi/g (Section 4.2.5). Results from the 20 background samples ranged from 0.15 pCi/g to 2.09 pCi/g, with an average of 0.75 (± 0.58) pCi/g. DOE-SR reported an approximate field measurement range of 1 pCi/g to 8**.**7 pCi/g, with an average of 1.46 pCi/g, from 388 deer harvested on the SRS in 2007 (WSRC 2008a). Average perimeter, background, and DOE-SR on-site Cs-137 levels for the past five years (Section 4.2.5) are indicated in Figure 1 (Section 4.2.3). The 2007 perimeter Cs-137 average result (0.62 (± 0.61) pCi/g) is within one standard deviation of the background result (0.75 (± 0.58) pCi/g). The 2003 to 2007 SCDHEC yearly Cs-137 average activity (1.19 (± 0.39) pCi/g) is within one standard deviation of the DOE-SR on-site average (2.60 (± 1.59) pCi/g). The five-year Cs-137 averages between SCDHEC and DOE-SR may differ for various reasons. The DOE-SR data is acquired in the field by using a portable sodium iodide detector while SCDHEC data results are analytical results. Also, the SCDHEC data present challenges for direct comparisons to DOE-SR data because the perimeter area is heavily baited with corn. Therefore, the uptake of Cs-137 by these animals will be reduced based on the increased K-40 levels in the corn from fertilizers (Heckman and Kamprath 1992).

CONCLUSIONS AND RECOMMENDATIONS

Although Cs-137 was deposited on the SRS from site operations, levels found in the study area and background location are likely results of global aboveground nuclear weapons testing (Haselow 1991). DOE-SR does not collect game animal samples within the SCDHEC study area and off-site hunter doses are based on DOE-SR models. Therefore, no direct comparisons could be made between ESOP and DOE-SR data.

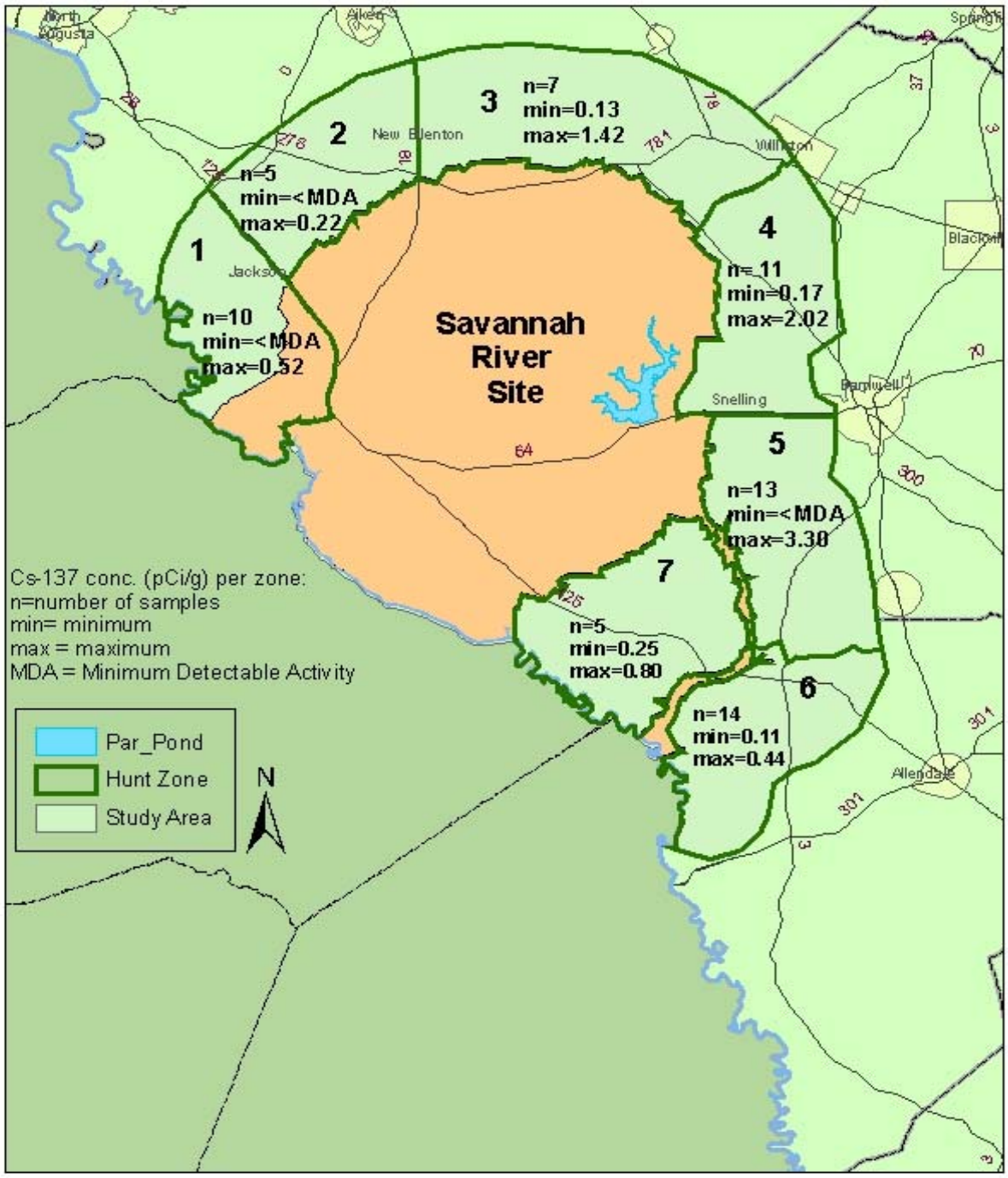
Age, sex, body weight, soil type, diet and collection location may affect the Cs-137 activities found in white-tailed deer and hogs (Haselow 1991). The differences in average activities indicated in Figure 1 (Section 4.2.3) are probably a combination of one or more of the above factors. A hunter consuming deer from SRS, the study area, or background locations would most likely ingest a portion of the activity associated with these animals. To have a better understanding of the concentration of consuming animals collected from these areas, please refer to the ESOP Critical Pathway Dose report.

A portion of the elevated Cs-137 activity found in deer harvested in hunt zones four, five and seven may be attributed to historic SRS operations indicated in Figure 2 (Section 4.2.3). These operations released known Cs-137 contamination to Steel Creek, Par Pond, and Lower Three Runs, their floodplains, and the Savannah River swamp, all of which impact hunt zones four, five and seven. Further research may be needed to help determine why elevated Cs-137 activities are found in other hunt units.

Back to Table of Contents

4.2.2 Map. 12 Cesium-137 Ranges in Game Animals Adjacent to SRS, 2007

Back to Maps



4.2.3 Tables and Figures

Back to Tables and Figures

Radiological Game Animal Monitoring Adjacent to SRS

FIGURE 1. AVERAGE CS-137 CONCENTRATION IN DEER, 2003-2007

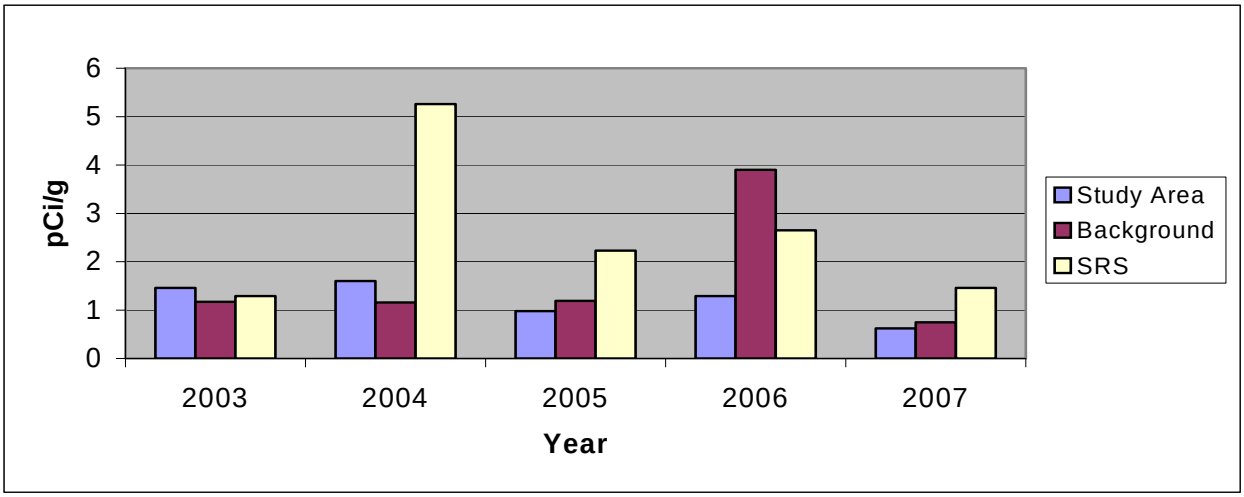
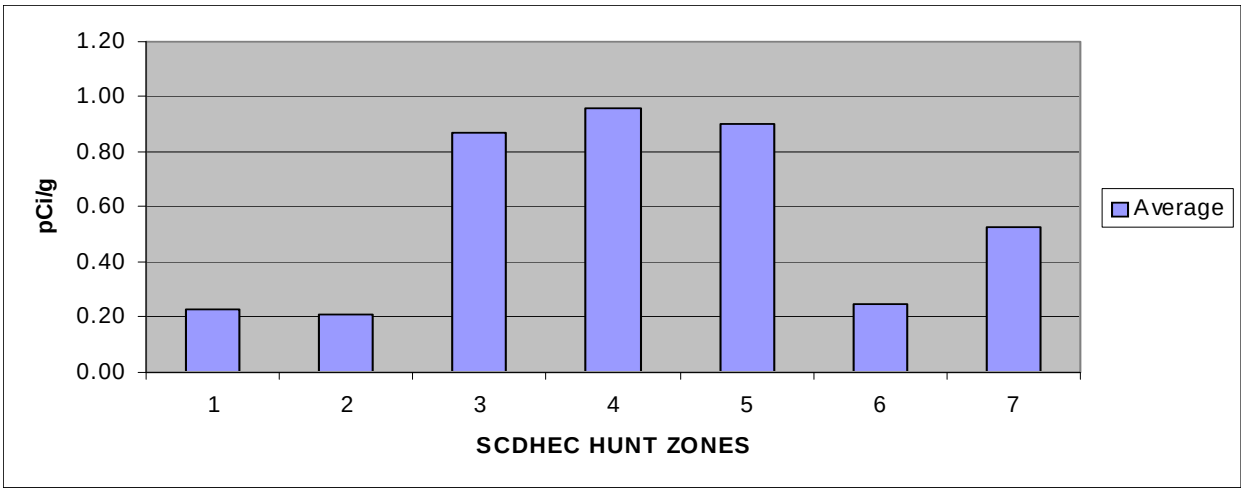


FIGURE 2. SCDHEC HUNT ZONE AVERAGE CS-137 CONCENTRATION IN DEER, 2007



4.2.4 Data Tables

Radiological Game Animal Monitoring Adjacent to SRS

Deer Analysis Results 382

Notes:

1. MDA - Minimum Detectable Activity
2. Sig - Sigma

Back to List of Data Tables

Radiological Game Monitoring
Game Animal Monitoring Data

Sample Location		Zone-1	Zone-1	Zone-1	Zone-1	Zone-1
Sample Date		10/19/2007	10/19/2007	10/19/2007	10/19/2007	10/19/2007
Species		Deer	Deer	Deer	Deer	Deer
Sex		Buck	Buck	Buck	Buck	Doe
Weight	Pounds	100	120	120	75	105
Cesium-137	(pCi/g) wet	0.15	<MDA	0.11	0.52	<MDA
Uncertainty	(+/- 2sig)	0.04	NA	0.04	0.06	NA
MDA	(pCi/g) wet	0.04	0.04	0.03	0.03	0.04

Sample Location		Zone-1	Zone-1	Zone-1	Zone-1	Zone-1
Sample Date		10/19/2007	10/19/2007	10/19/2007	10/19/2007	10/19/2007
Species		Deer	Deer	Deer	Deer	Deer
Sex		Buck	Doe	Buck	Buck	Buck
Weight	Pounds	100	90	95	120	130
Cesium-137	(pCi/g) wet	<MDA	<MDA	0.24	0.13	<MDA
Uncertainty	(+/- 2sig)	NA	NA	0.05	0.03	NA
MDA	(pCi/g) wet	0.04	0.04	0.04	0.03	0.04

Sample Location		Zone-2	Zone-2	Zone-2	Zone-2	Zone-2
Sample Date		10/12/2007	9/30/2007	9/30/2007	10/7/2007	10/6/2007
Species		Deer	Deer	Deer	Deer	Deer
Sex		Buck	Buck	Buck	Buck	Doe
Weight	Pounds	130	130	120	140	70
Cesium-137	(pCi/g) wet	0.22	<MDA	0.21	<MDA	0.19
Uncertainty	(+/- 2sig)	0.05	NA	0.05	NA	0.04
MDA	(pCi/g) wet	0.04	0.04	0.04	0.04	0.04

Sample Location		Zone-3	Zone-3	Zone-3	Zone-3	Zone-3
Sample Date		9/18/2007	10/22/2007	10/22/2007	10/22/2007	11/7/2007
Species		Deer	Deer	Deer	Deer	Deer
Sex		Buck	Doe	Buck	Buck	Buck
Weight	Pounds	120	100	95	105	125
Cesium-137	(pCi/g) wet	0.29	1.00	1.21	1.29	0.72
Uncertainty	(+/- 2sig)	0.05	0.10	0.12	0.12	0.08
MDA	(pCi/g) wet	0.03	0.03	0.02	0.02	0.04

Sample Location		Zone-3	Zone-3
Sample Date		11/7/2007	11/7/2007
Species		Deer	Deer
Sex		Buck	Doe
Weight	Pounds	165	90
Cesium-137	(pCi/g) wet	0.13	1.42
Uncertainty	(+/- 2sig)	0.04	0.14
MDA	(pCi/g) wet	0.04	0.03

Sample Location		Zone-4	Zone-4	Zone-4	Zone-4	Zone-4
Sample Date		11/3/2007	11/3/2007	11/3/2007	10/31/2007	10/31/4007
Species		Deer	Deer	Deer	Deer	Deer
Sex		Buck	Doe	Buck	Buck	Doe
Weight	Pounds	135	75	50	65	85
Cesium-137	(pCi/g) wet	0.17	1.03	2.02	1.88	0.90
Uncertainty	(+/- 2sig)	0.04	0.11	0.18	0.17	0.09
MDA	(pCi/g) wet	0.04	0.04	0.04	0.04	0.04

Sample Location		Zone-4	Zone-4	Zone-4	Zone-4	Zone-4	Zone-4
Sample Date		10/31/2007	10/7/2006	12/8/2007	12/8/2007	12/8/2007	12/8/2007
Species		Deer	Deer	Deer	Deer	Deer	Deer
Sex		Buck	Doe	Buck	Buck	Buck	Buck
Weight	Pounds	110	70	90	60	115	185
Cesium-137	(pCi/g) wet	1.18	0.40	0.59	1.31	0.84	0.21
Uncertainty	(+/- 2sig)	0.12	0.06	0.07	0.13	0.10	0.05
MDA	(pCi/g) wet	0.04	0.04	0.04	0.04	0.03	0.03

Radiological Game Monitoring
Game Animal Monitoring Data

Sample Location		Zone-5	Zone-5	Zone-5	Zone-5	Zone-5	Zone-5
Sample Date		10/4/2007	10/1/2007	9/15/2007	10/19/2007	10/20/2007	10/19/2007
Species		Deer	Deer	Deer	Deer	Deer	Deer
Sex		Buck	Buck	Buck	Doe	Buck	Buck
Weight	Pounds	205	120	60	100	165	125
Cesium-137	(pCi/g) wet	0.32	1.66	3.30	0.57	0.13	0.86
Uncertainty	(+/- 2sig)	0.04	0.20	0.30	0.66	0.03	0.09
MDA	(pCi/g) wet	0.02	0.02	0.02	0.02	0.02	0.02

Sample Location		Zone-5	Zone-5	Zone-5	Zone-5	Zone-5	Zone-5
Sample Date		10/13/2007	11/27/2007	11/27/2007	11/27/2007	11/27/2007	12/8/2007
Species		Deer	Deer	Deer	Deer	Deer	Deer
Sex		Buck	Buck	Doe	Buck	Doe	Buck
Weight	Pounds	165	180	110	125	85	165
Cesium-137	(pCi/g) wet	1.01	1.64	0.36	< MDA	0.20	0.16
Uncertainty	(+/- 2sig)	0.10	0.16	0.06	NA	0.04	0.04
MDA	(pCi/g) wet	0.02	0.04	0.04	0.03	0.04	0.05

Sample Location		Zone-5
Sample Date		12/8/2007
Species		Deer
Sex		Buck
Weight	Pounds	120
Cesium-137	(pCi/g) wet	0.56
Uncertainty	(+/- 2sig)	0.07
MDA	(pCi/g) wet	0.04

Sample Location		Zone-6	Zone-6	Zone-6	Zone-6	Zone-6	Zone-6
Sample Date		10/20/2007	10/8/2007	11/23/2007	11/23/2007	11/23/2007	11/23/2007
Species		Deer	Deer	Deer	Deer	Deer	Deer
Sex		Buck	Buck	Doe	Doe	Buck	Doe
Weight	Pounds	115	165	55	60	65	85
Cesium-137	(pCi/g) wet	0.31	0.11	0.20	0.18	0.22	0.30
Uncertainty	(+/- 2sig)	0.04	0.03	0.04	0.04	0.03	0.04
MDA	(pCi/g) wet	0.02	0.02	0.02	0.02	0.03	0.03

Sample Location		Zone-6	Zone-6	Zone-6	Zone-6	Zone-6	Zone-6
Sample Date		11/23/2007	11/23/2007	11/23/2007	11/23/2007	11/23/2007	11/23/2007
Species		Deer	Deer	Deer	Deer	Deer	Deer
Sex		Buck	Buck	Doe	Doe	Buck	Buck
Weight	Pounds	95	125	65	75	130	145
Cesium-137	(pCi/g) wet	0.16	0.28	0.39	0.31	0.44	0.24
Uncertainty	(+/- 2sig)	0.04	0.04	0.05	0.05	0.05	0.04
MDA	(pCi/g) wet	0.02	0.03	0.02	0.03	0.02	0.02

Sample Location		Zone-6	Zone-6
Sample Date		11/23/2007	11/23/2007
Species		Deer	Deer
Sex		Buck	Doe
Weight	Pounds	170	90
Cesium-137	(pCi/g) wet	0.12	0.19
Uncertainty	(+/- 2sig)	0.03	0.04
MDA	(pCi/g) wet	0.03	0.03

Sample Location		Zone-7	Zone-7	Zone-7	Zone-7	Zone-7
Sample Date		10/12/2007	10/12/2007	11/1/2007	11/1/2007	11/1/2007
Species		Deer	Deer	Deer	Deer	Deer
Sex		Buck	Buck	Doe	Buck	Buck
Weight	Pounds	163	150	80	70	145
Cesium-137	(pCi/g) wet	0.48	0.58	0.53	0.80	0.25
Uncertainty	(+/- 2sig)	0.06	0.06	0.07	0.08	0.04
MDA	(pCi/g) wet	0.02	0.02	0.04	0.04	0.04

Radiological Game Monitoring
Background Data

Sample Location		Background	Background	Background	Background	Background
Sample Date		11/2/2007	11/2/2007	11/2/2007	11/2/2007	11/2/2007
Species		Deer	Deer	Deer	Deer	Deer
Sex		Buck	Buck	Buck	Buck	Buck
Weight	Pounds	80	87	130	157	95
Cesium-137	(pCi/g) wet	0.37	1.06	0.53	0.15	0.30
Uncertainty	(+/- 2sig)	0.05	0.11	0.07	0.03	0.04
MDA	(pCi/g) wet	0.03	0.03	0.02	0.03	0.03

Sample Location		Background	Background	Background	Background	Background
Sample Date		11/2/2007	11/2/2007	11/2/2007	11/2/2007	11/2/2007
Species		Deer	Deer	Deer	Deer	Deer
Sex		Buck	Doe	Buck	Buck	Buck
Weight	Pounds	154	60	120	112	93
Cesium-137	(pCi/g) wet	0.50	0.18	0.66	0.34	2.09
Uncertainty	(+/- 2sig)	0.06	0.03	0.08	0.04	0.19
MDA	(pCi/g) wet	0.02	0.03	0.02	0.03	0.03

Sample Location		Background	Background	Background	Background	Background
Sample Date		11/2/2007	11/2/2007	11/2/2007	11/2/2007	11/2/2007
Species		Deer	Deer	Deer	Deer	Deer
Sex		Doe	Buck	Buck	Doe	Doe
Weight	Pounds	84	103	148	85	88
Cesium-137	(pCi/g) wet	1.02	0.32	0.69	1.42	1.60
Uncertainty	(+/- 2sig)	0.10	0.52	0.08	0.14	0.15
MDA	(pCi/g) wet	0.03	0.03	0.03	0.03	0.03

Sample Location		Background	Background	Background	Background	Background
Sample Date		11/2/2007	11/2/2007	11/2/2007	11/2/2007	11/2/2007
Species		Deer	Deer	Deer	Deer	Deer
Sex		Buck	Buck	Buck	Buck	Doe
Weight	Pounds	167	144	120	100	77
Cesium-137	(pCi/g) wet	0.60	0.17	0.76	1.89	0.38
Uncertainty	(+/- 2sig)	0.07	0.04	0.08	0.17	0.05
MDA	(pCi/g) wet	0.03	0.02	0.03	0.03	0.03

Back to List of Data Tables

4.2.5 Summary Statistics

Radiological Game Animal Monitoring Adjacent to SRS

Summary Statistics.....386

Notes:

1. N - Number of Samples
2. Std.Dev. - Standard Deviation
3. Min - Minimum
4. Max - Maximum
5. MDA - Minimum Detectable Activity
6. Average, Std.Dev., and Median calculated using detections only

Back to List of Summary Statistics

Radiological Game Animal Monitoring Adjacent to SRS

Cs-137 concentration (pCi/g wet weight) in deer collected in 2007

	N	Average	Std. Dev.	Median	Min.	Max
Study Area	65	0.62	0.61	0.36	< MDA	3.30
Background	20	0.75	0.58	0.57	0.15	2.09

Cs-137 concentration (pCi/g wet weight) in deer collected in 2007 SCDHEC Hunt Zones

Hunt Zone	N	Average	Std. Dev.	Median	Min.	Max
Zone 1	10	0.23	0.17	0.15	< MDA	0.52
Zone 2	5	0.21	0.02	0.21	< MDA	0.22
Zone 3	7	0.87	0.50	1.00	0.13	1.42
Zone 4	11	0.96	0.62	0.90	0.17	2.02
Zone 5	13	0.90	0.92	0.57	< MDA	3.30
Zone 6	14	0.25	0.10	0.23	0.11	0.44
Zone 7	5	0.53	0.20	0.53	0.25	0.80

Cs-137 concentration (pCi/g wet weight) in deer collected from 2003 - 2007

	Year	N	Average	Std.Dev	Median	Min.	Max.
Study Area	2003	50	1.46	1.31	1.09	0.07	5.80
Background	2003	7	1.17	0.88	0.78	0.49	2.92
SRS	2003	1128	1.29	NA	NA	1.00	17.10
Study Area	2004	50	1.60	1.10	1.31	0.07	4.56
Background	2004	15	1.16	0.63	1.18	0.34	2.44
SRS	2004	817	5.26	NA	NA	1.00	48.30
Study Area	2005	66	0.98	0.87	0.70	< MDA	4.32
Background	2005	15	1.19	0.38	1.25	0.48	1.60
SRS	2005	215	2.32	NA	NA	1.00	8.10
Study Area	2006	68	1.29	1.05	0.85	< MDA	3.90
Background	2006	60	3.90	1.38	3.86	1.17	7.02
SRS	2006	324	2.65	NA	NA	1.00	9.05
Study Area	2007	65	0.62	0.61	0.36	< MDA	3.30
Background	2007	20	0.75	0.58	0.57	0.15	2.09
SRS	2007	388	1.46	NA	NA	1	8.70
Study Area	' 03 - ' 07	299	1.19	0.39	1.29	< MDA	5.8
Background	' 03 - ' 07	117	1.63	1.28	1.17	0.15	7.02
SRS	' 03 - ' 07	2872	2.60	1.59	2.32	1.00	48.30

Back to List of Summary Statistics

5.1 Critical Pathway Dose Report

5.1.1 Summary

Atmospheric pathway (APW) and liquid pathway (LPW) discharges from the Savannah River Site (SRS) were monitored by the Department of Energy – Savannah River (DOE-SR) contractor Washington Savannah River Company, Environmental Monitoring Section. The Environmental Surveillance and Oversight Program (ESOP) of the South Carolina Department of Health and Environmental Control (SCDHEC) also monitored the SRS and perimeter areas under an Agreement in Principle with the DOE. DOE-SR and SCDHEC used data from these monitoring activities to calculate the potential radiation dose to the surrounding public. SCDHEC implemented a Radionuclide Dose Calculation Project and a Critical Pathway Project to calculate the potential exposure or dose to the public within 50-miles of an SRS center-point. These two reports were combined into one report starting in 2007. Historical missions and data in previous years reports, primarily the SRS Environmental Reports (1993-2007), the Risk Assessment Corporation report (Till et al. 2001), and the Centers for Disease Control study (CDC 2004) helped to establish the SCDHEC (1999-2007) Critical Pathway Dose report basis. Radionuclide dose or potential exposure to the public was calculated from radionuclide concentration activities found in various media that may impact the public (Section 5.1.3). A comparison of similar SCDHEC and DOE-SR media resulted in an evaluation of both programs based on averages and standard deviations (Section 5.1.1). Summary statistics (Section 5.1.4), and tables and figures (Section 5.1.2) illustrate the trends and central tendencies in the critical pathway dose.

Three basic dose exposure scenarios were developed, which help the public to determine dose relative to their media exposure activities. The general Public dose scenario potential exposure includes the average dose above background detected by air filters, edible vegetation, milk, and the highest public water supply dose. This scenario is for the nonsportsman who is not exposed to forest soils, sediments, game, or other water dose in remote locations. The Farmer dose scenario potential exposure includes the average dose above background detected by TLD, air filters, edible vegetation, milk, soil, sediments, and the highest groundwater supply dose. This scenario is for the nonsportsman farmer who is not exposed to game or other water dose in remote locations. The Average Sportsman dose scenario potential exposure includes the average dose above background detected by TLD, air filters, edible vegetation, milk, fish, soil, sediments, average deer and hog, and the single highest potential drinking water exposure.

The general public dose was 0.16 mrem in 2007, and averaged 0.12 mrem, ± one standard deviation (0.09), with a median of 0.09 mrem for 1999-2007; the farmer dose was 0.58 mrem in 2007, and averaged 0.92 (± 1.19) mrem, with a median of 0.15 mrem for 199-2007; and the average sportsman was 1.01 mrem in 2007, and averaged 2.27 (± 1.71) mrem with a median of 1.72 mrem for 1999-2007 (Table 5, Section 5.1.2).

Most of the average dose was the result of atmospheric deposits (73.23 %) and the balance was from the liquid route (26.77 %). The sportsman pathway contributed the greatest dose to the public from 1999 through 2007, primarily through food ingestion dose (59.14 %) from game animal and fish consumption of cesium-137 (Cs-137) (Table 6, Section 5.1.2). The second highest dose pathway was due to direct exposure (34.20 %), primarily from soil ambient beta-gamma, unknown alpha, and unknown beta. Nonpotable water consumption, primarily river

water, was the third major pathway (4.19 % of dose) with radium-226 (Ra-226) as the main contributor to dose. Potable public water supply sources were fourth (2.16 % of dose) due to tritium and unknown beta, and inhalation was fifth at 0.30 % of the dose primarily from unknown alpha. Nonsportsman food (milk and vegetables) contributed 0.14 mrem to the average dose in 2007 and averaged 0.08 (± 0.08) mrem with a median of 0.05 mrem (Table 8, Section 5.1.2). The main nonNORM radionuclide dose contributors from 1999 through 2007 were Cs-137 (14.35 mrem), tritium (0.67 mrem), and strontium-89/90 (Sr-89/90) (0.58 mrem). Unidentified alpha (7.13 mrem), beta-gamma (6.69 mrem), and Ra-226 (4.85 mrem) were the main NORM contributors to dose (Table 2, Section 5.1.4).

The SCDHEC Maximally Exposed Individual (MEI) was primarily a sportsman scenario because most dose came from game animals and fish. The SCDHEC MEI assumed the extreme view that this sportsman was a subsistence and survivalist type of individual who resided in the downriver swamp area below all SRS contributions to the Savannah River and received the maximum dose possible. Perimeter exposure may be viewed either on an average (1.009 mrem) or single maximum detection (5.677 mrem) basis. Note the perimeter average dose was 1.009 mrem total in 2007 and the maximum radionuclide activity concentration excluding NORM (MaxRACx) total cannot be greater than 5.677 mrem for all dose potentially from SRS or 13.077 mrem for the maximum NORM (MaxNORM) total. However, these totals were based on SCDHEC detections only. Tables 5 and 7 of Section 5.1.2 illustrate how the DOE-SR offsite hog dose estimate can be added to give a total offsite potential dose of 7.98 mrem or combined onsite and offsite dose potential of 19.62 mrem for the MEI.

The SCDHEC 2007 maximum exposure from the airborne pathway (0.006 mrem) and liquid consumption (0.445 mrem, mostly unknown alpha and possible NORM) was within the respective 10 mrem and 4 mrem DOE limits (Table 1, Section 5.1.2). A maximum dose potential excluding NORM (19.447 mrem) was calculated from SCDHEC and DOE-SR combined data, and was within the 100-mrem DOE dose limit. Inhalation was 0.198 % of the dose to the critical pathway, ingestion was 59.406 %, and direct exposure was 40.396 %. SCDHEC samples indicated that the primary pathway influence shifted from the liquid pathway to the atmospheric pathway, if dose was based on extremes as an achievable dose instead of averages. The **Average R**adionuclide **A**ctivity **C**oncentration (AvgRACx) dose basis excluding (**x**) NORM (1.009 mrem in 2007) was considered the typical dose that most individuals can expect from sampled media.

RESULTS AND DISCUSSION

The public should consider the average dose as the more typical potential exposure and the results and percentages discussed are on an average basis unless otherwise noted. Radiation exposures to the MEI from each exposure media were categorized into two primary exposure pathways (atmospheric, liquid pathways) that are subdivided into other more specialized exposure routes (inhalation, ingestion, and direct exposure by media), (Figure 1, Section 5.1.2). Three critical pathway dose scenarios were developed based on lifestyle activities that determine media exposure (public, farmer, sportsman). The dose from the radionuclides were organized to represent an additive dose estimate for 2007 occurring in specialized pathways, which represented types of media exposure due to lifestyles (e. g., potable and nonpotable drinking water media, farming, general public recreation, and sportsman). All drinking water doses were

not added together, since a consumption source or a maximum exposure for a particular scenario had to be assumed (illustrates why the upper bound calculation is not a realistic potential dose). A brief comparison based on averages and standard deviation was made to dose estimate values published by the DOE-SR (Table 2, Section 5.1.2). This comparison assisted in evaluating the 2007 DOE-SR environmental monitoring program and the SCDHEC ESOP environmental monitoring program.

All dose was summarized by average, standard deviation, and median. The median may be a better indicator of the central tendency in environmental media dose compared to average dose for large sample numbers due to: 1- the decrease in influence by the extremes; 2- the added conservancy present in selected dose factors; 3- the addition of dose based on maximums such as hog and deer worst-case game animal consumption; 4- the use of "detections only" for statistical analyses when many sample results were less than the detection limit; 5- the counting of some dose twice when a particular alpha or beta was counted by species for radionuclides; 6 – the assignment of unknown alpha and beta as plutonium-239 (Pu-239) and Sr-90 respectively in dose calculations biases the MEI dose high, if the assigned dose is actually NORM; 7- the assignment of the higher dose to dual radionuclide determinations (e.g., the assignment of dose based on Sr-90 when the detection is for Sr-89/90); 8 –the use of 0.00 mrem as background for <MDA data averages; and 9 –the influence or potential of false positives.

However, average dose was given prominence as protective for dose considerations, and the reader should be aware that the average dose estimate was conservative or biased high by a factor of approximately two due to unknowns that contained assigned dose. All detected dose above background was assigned either to the MEI dose or NORM dose dependent on assignable cause that was based on knowledge of environmental sources, media, and locations (Table 1, Section 5.1.2). For example, the potential dose in resuspended soils was not assigned as farmer inhalation, if not detected by air samplers.

Three basic scenarios (public, farmer, and average sportsman) were developed as estimates for the general public dose potential based on lifestyle activities (Table 5, Section 5.1.2). The 2007-year public scenario dose (0.16 mrem) was based on the dose potential from air, the highest public water supply, milk, edible vegetation, and general recreation activities such as boating and swimming. The farmer scenario dose (0.58 mrem) was based on adding to the general public dose the highest dose from groundwater in place of the public water supply, and adding soil, sediment, and ambient beta-gamma to the public dose. The average sportsman dose (1.01 mrem) was based on adding the fish and game animal average dose to the farmer dose and substituting the highest surface water dose (sportsman may boil surface water for consumption in the field) as drinking water.

The public can estimate their potential dose based on activities that involve exposure to one or more media not covered by these scenarios. Each individual can add one or more maximum dose detections (from the MaxRACx and/or MaxNORM columns in Table 1, Section 5.1.2) to the perimeter average dose and subtract the corresponding media average dose to calculate their own dose potential, if different from one of these scenarios. For example, a member of the general public who received deer meat for consumption, but did not hunt, can add the deer maximum (2.660) to the Perimeter Average Dose to obtain a dose of 3.669 mrem and then subtract the corresponding media average for deer (0.00). The corresponding average dose for

that media must be subtracted from that total. Thus, by adding deer meat from the local area to the diet, the yearly dose potential would increase from 0.16 mrem (public scenario) to 1.01 mrem (average sportsman scenario) with the remote possibility of receiving a maximum of 3.669 mrem for the worst-case single hunter consumption. This would be a personal dose versus the highest maximum dose detections that included NORM for the MEI (18.754 mrem) based on SCDHEC data alone. Each media radionuclide dose average above background was considered as part of a different critical pathway lifestyle scenario with contributions through the inhalation, ingestion, and direct exposure routes (Table 1, Section 5.1.2). The air inhalation (0.006 mrem), food ingestion (4.086 mrem), and direct exposure (1.109 mrem) totals were added to the highest drinking water dose (0.445 mrem) and the swimming ingestion dose (0.031 mrem) to obtain the SCDHEC MEI total dose (5.677 mrem). One or more maximums can be added to the Perimeter Average Dose (1.009 mrem) basis to estimate a specific potential dose with the caveat that the total cannot be higher than 5.677 mrem for assignable dose excluding NORM (MaxRACx column) or 18.754 mrem, if the MaxNORM (13.077 mrem) dose is added to the MaxRACx column (5.677 mrem). However, Tables 5 and 7 of Section 5.1.2 illustrate how the DOE-SR offsite hog dose estimate can be added to give a total offsite potential dose of 7.98 mrem, and a combined onsite and offsite dose potential of 19.62 mrem for the MEI excluding NORM. Thus, DOE-SR did not exceed the 100-mrem release limit based on the combined SCDHEC and DOE-SR MEI dose detections in 2007.

The All-Sources Maximum Upper Bound total included NORM detections and cannot be used as an MEI due to the inclusion of NORM; and either a single maximum water source must be used or the consumption rate proportions modified for including other water source maximums. All drinking water sources cannot be added together since the dose for any drinking water source is calculated at a maximum consumption rate and you cannot drink at the maximum consumption rate except from one source. This All-Sources Maximum total dose (19.349 mrem) was the Upper Bound dose detection limit for SCDHEC data in 2007 based on using only maximum detections regardless of whether the dose can be assigned. Table 1of Section 5.1.2 lists an All-Sources Dose Upper Bound total (5.769 mrem) and a Perimeter Dose Total (5.677 mrem). The All-Sources Dose Upper Bound total is not the MEI because each drinking water source dose was calculated at the maximum consumption rate. Since only one drinking water maximum could be added to the MEI dose, the highest dose was used (underlined). This MEI was a single sportsman who received the perimeter maximum dose from all applicable media that excluded possible naturally occurring radioactive material (NORM) detections. Only an extremely small chance existed that a single sportsman could be at all locations where and when the maximums occurred, and manage to achieve all of the consumption rates without a change in exposure over the entire year. The All-Sources Maximum or Upper Bound for detections was simply all available dose based on the single highest detections per media without qualification as to applicability (19.349 mrem)(Table 1, Section 5.1.2). However, an extremely low chance exists for one rare individual achieving the maximum limit of available dose (18.754 mrem in 2007) based on maximums calculated from extreme outliers in all media that included NORM detections and one drinking water maximum. Also, three scenarios were developed, which help the public to determine a dose relative to their media exposure activities (Table 5, Section 5.1.2). Should the individual exposure activity overlap other areas not considered in the scenarios, the individual may add any maximum in place of an average dose for that media from Table 1,

Section 5.1.2. The substitution of deer and fish dose maxima for deer and fish dose averages were given as examples of how to determine personal scenario totals (Table 1, Section 5.1.2).

Note the 1.009 mrem 2007 perimeter dose is the same dose attributed to watching TV for one year; and the 19.349 mrem All-Sources maximum, that includes NORM, is less than the dose typically received from cosmic radiation (26 mrem). The average NORM received by all individuals in the United States is 300 mrem (Figure 2, Section 5.1.2).

The dose calculations general method and project development was detailed in the Critical Pathway Dose Project Plan (SCDHEC 2007g). The original calculations were rounded to comparable significant digits for DOE-SR comparisons. Statistical summaries of the dose (mrem) average, standard deviation, and median were done for the radionuclides detected in sampled media, and tabulated for scenarios, media and radionuclides (Sections 5.1.2 and 5.1.4). The following sections present comparisons of dose data from multiple pathway scenarios to define the observed dose for a particular lifestyle scenario with conservative parameters. Consequently, any error in dose estimations should be on the high side.

The 1999-2007 critical pathway data summary excluding NORM indicated that the atmospheric pathway detections in media (73.23%) contributed most of the dose to the MEI versus the liquid pathway (26.77%) media (Table 6, Figure 3, Section 5.1.2) on an average basis. Most of the ingestion pathway dose came from food sources (59.14%) that were mostly game animals or fish (Table 6, Section 5.1.2). These percentages would increase primarily in the food categories, if maximums were added to a scenario average. The direct exposure route (34.20%) was second, followed by untreated water sources (4.19%), public water supplies (2.16%), and the inhalation pathway (0.30%).

The average dose in millirem by media from 1999-2007 indicated hog was highest (1.53), followed by thermoluminescent dosimeter ambient beta-gamma (0.74), fish (0.49), deer (0.34), milk and surface and river water (0.06), groundwater (0.05), soil (0.04), PWS river water and edible vegetation (0.03), riverbank sediments and PWS groundwater (0.02), and rainwater and air (0.01) (Table 1, Section 5.1.4). Consideration of dose based on single worst-case maximums shifts the media dose order dramatically since the sportsman media have the highest potential for exposure. For example, the dose percent contribution from average deer would shift from 13.04 % for the period 1999-2007 (2.75 mrem/21.095*100%) to 65.88 % (67.56/102.555*100%) of dose, if the deer and hog maximums were substituted for the average deer and hog during the same period. The maximum deer and hog dose was based on a single hunter consuming the edible portion of the highest deer and hog dose. This highest deer dose would apply to only a single consumer or hunter who eats all the edible portion of that meat. Figures 6 and 7 of Section 5.1.2 illustrated media comparisons on an average and median dose basis.

The primary radionuclides for the period 1999-2007 that contributed to the MEI dose and were not naturally occurring (nonNORM) were cesium-137 (Cs-137) at 39.00% of the dose, tritium at 1.83% of the dose, and Sr-89&90 at 2.18% of the dose (Table 3, Section 5.1.4). Alpha assigned as Pu-239 (19.37%), beta assigned as Sr-90 (0.94%), and ambient beta-gamma (18.19%) were significant unknowns contributing to dose above background that may reflect mostly NORM occurring within the study area. Note that 38.50 % of the dose was assigned and represents a

potential dose overestimate that may in fact be NORM detections. Other NORM above background greater than 1% of the dose were radium-226 (13.20%), lead-214 (Pb-214) at 1.39%, and actinium-228 (1.35%). Only 44.25% of the detected dose above background (radionuclides not highlighted in Table 3, Section 5.1.4) was potentially from SRS if all NORM potentials were excluded. However, assigned dose and NORM dose were included as a protective estimate. DOE-SR used the same assigned dose for unknown alpha and beta detections.

Four SCDHEC conservative scenarios for public exposure to radionuclides from 1999 through 2007 were averaged and summarized as follows: the general Public average dose was 0.12 (± 0.09) mrem with a median of 0.09 mrem; the Farmer average dose was 0.92 (± 1.19) mrem with a median of 0.15 mrem; and the Average Sportsman dose was 2.27 (± 1.71) mrem with a median of 1.72 mrem (Table 5, Section 5.1.2). The additional NORM detections averaged 1.37 (± 1.43) mrem with a median of 1.20 mrem. The grand average dose for MEI plus NORM detected by SCDHEC from 1999 through 2007 was 12.69 (± 10.97) mrem with a median of 8.68 mrem. Note that the MEI median and the MEI plus NORM median are the same (8.68 mrem), which covers a nine-year period with over a thousand samples.

A 2007 dose limit or upper bound based on exposure to the single highest dose detection per media that includes NORM above background for an entire year was 19.349 mrem (Table 1, Section 5.1.2). This All-Sources Maximum Upper Bound is not an achievable dose by the MEI based on temporal and location improbabilities, the same maximum consumption factor for all water sources (not proportioned out), and the fact that single maximum detections are treated as if they occurred at unvarying concentration activities throughout the entire year. This upper bound based on SCDHEC detections was 19.349 mrem in 2007 and does not exceed the 100 mrem DOE-SR dose limit. Therefore, the public was not exposed to greater than the allowed dose from DOE-SR in 2007 under any scenario.

This project used dose instead of risk so that direct comparisons of dose magnitude can be made with data published in the SRS Environmental Reports. USEPA and SCDHEC both use risk calculations when determining clean-up levels at Comprehensive Environmental Resource Compensation and Liability Act (CERCLA) and Resource Conservation Recovery Act (RCRA) sites.

The Atmospheric Pathway

The potential dose to the MEI from the SRS atmospheric releases is reviewed in the SRS annual Environmental Reports. The National Admission Standards for Hazardous Air Pollutants (NESHAP) for all radionuclide air pollutants in 2007 is 0.04 mrem for the MEI effective dose equivalent for both CAP88 and MAXDOSE-SR code estimates (WSRC 2008a). This is 0.4 % of the 10 mrem/yr EPA standard. The atmospheric pathway contributed accumulated dose to the individual through the inhalation, ingestion (cow milk, vegetation, rainwater, and meat), and direct exposure routes.

The ESOP average detected dose potential from the atmospheric pathway media excluding NORM totaled 0.398 mrem in 2007 (Table 1, Section 5.1.2). The NORM contributions to the average atmospheric pathway were 1.673 mrem for a total dose of 2.071 mrem from the atmospheric pathway. The addition of any maximums from the sportsman category of media

exposure drastically changes the dose and percentages for radionuclides and pathways. Another example of dose assigned as NORM (1.436 mrem of unknown alpha) comes from natural areas that may be farmed and the soil resuspended and inhaled (Section 5.1.3, Air and Soil Data). This potential was not backed up by air station filter detections in 2007 soil samples. The native soil samples cannot be taken directly from plowed fields due to the influence of fertilizers and other chemicals added by the farmer. Also, soil samples were not taken from disturbed areas such as roadbed or construction areas due to the influence of deposited nonnative material.

The maximum limit of available dose or upper bound for the 2007 MEI atmospheric dose was based on exposure to the single highest maximums per media for the entire year (3.824 mrem), and 12.380 mrem additional NORM or 16.204 mrem upper bound for the atmospheric pathway (Table 1, Section 5.1.2). The addition of an upper bound calculation illustrates that the MEI atmospheric exposure could not be greater than 16.204 mrem for any scenario in 2007 based on sample media maximum detections, which is well under the DOE-SR limit of dose to the public (100 mrem). Note that atmospheric pathway refers to depositions accumulated over many years and not inhalation in a single year. This should not be compared to the 10-mrem yearly air dose limit for the atmospheric pathway. The atmospheric pathway and liquid pathway upper bound calculations illustrate that the DOE-SR 100 mrem limit could not have been exceeded for both pathways combined (3.145 mrem liquid upper bound plus 16.204 mrem atmospheric upper bound equals 19.349 mrem).

The 1999-2007 atmospheric pathway dose (15.45 mrem) was 73.23% of the average dose (Table 1, Section 5.1.4). Exposure from average food detections (12.48 mrem) subject to the atmospheric pathways was 59.14 % of the average dose. The atmospheric direct exposure pathway that includes riverbank dried sediment resuspension (7.21 mrem) was 34.20 % of the average dose (uses average deer dose instead of maximum deer dose).

The SCDHEC and DOE-SR Atmospheric Pathway Comparison

SCDHEC detected less air inhalation dose (0.002 mrem) than estimated by DOE-SR (0.0173 mrem) releases because all releases are not detected and are not necessarily deposited within the 50-mile study area. Four comparable SCDHEC and DOE-SR media pathway dose results were totaled and averaged to give a media pathway average for 2007 in Table 2, Section 5.1.2. Both agencies were within one standard deviation of the other. Compare the SCDHEC (0.91 (± 1.48) mrem) and DOE-SR (1.28 (± 1.46) mrem) pathway averages. Most of the atmospheric difference was due to a single Sr-89/90 detection in soybeans of 0.0505 pCi/g by SCDHEC, and a higher maximum deer dose detection for SCDHEC (2.66 mrem) versus DOE-SR (1.90 mrem) (Data Tables, Section 5.1.3). Average dose uptake after deposition from the atmospheric pathway was the dominant route of exposure to the public via the food, soil, and airborne pathways.

Not all SRS dose releases result in depositions within the sample area, as evidenced by the inhalation pathway detections noted in the previous paragraph, which are far less than SRS releases. Also, many years of cumulative dose depositions contribute to the dose detections in any given year and make potential dose releases by DOE-SR versus SCDHEC detections not directly comparable. The ESOP detected atmospheric media dose averages for 1999-2007 were:

hog at 1.53 (± 1.87) mrem, median 0.97 mrem; thermoluminescent dosimeters (TLD) direct beta-gamma at 0.74 (± 1.12) mrem, median 0.00 mrem; average deer at 0.34 (± 0.49) mrem, median 0.15 mrem; milk at 0.06 (± 0.08) mrem, median 0.04 mrem; soil at 0.04 (± 0.08) mrem, median 0.01 mrem; edible vegetation at 0.03 (± 0.05) mrem, median 0.01 mrem; and air at 0.01 (± 0.01) mrem, median 0.01 mrem. (Table 1, Section 5.1.4).

The DOE-SR air medium contributes to the plume, ground, inhalation, and food exposure pathways as shown in Figure 1, Section 5.1.2. The plume exposure pathway potential has not exceeded one percent of the total dose to the MEI in the last fifteen years (Table 3, Section 5.1.2). SCDHEC has not detected plume exposure for the public since ESOP's formation (due to the reactors being shut down in 1988). Tritium, iodine-129 (I-129), unspecified alpha, Cs-137, plutonium-238 (Pu-238), nonvolatile beta, Pu-239, and plutonium-240 (Pu-240) (in that order) account for the majority of the total potential committed dose to the MEI from DOE-SR air releases in 2007. The DOE-SR calculated dose to the food pathway: vegetation (39.6 %), cow milk (10.9 %), and meat (4.6 %) pathways was 55.1 % of the atmospheric releases in 2007 (WSRC 2008a). The DOE-SR calculated dose to the inhalation pathway was 41.1 % of the atmospheric releases in 2007. The DOE-SR calculated dose to the ground pathway was 3.8 % from atmospheric releases. DOE-SR radionuclide releases were not directly comparable to ESOP dose detections in media, since media may contain or bioconcentrate several years of dose releases. The SCDHEC order of radionuclide detected dose in the 2007 atmospheric pathway excluding assigned NORM was Cs-137 in deer, unknown beta in soil assigned as Sr-90, Sr-89/90 in soybeans, and Cs-137 in Savannah riverbank soil.

Table 6 of Section 5.1.2 shows the total nine-year millirem dose and percent of dose on an average basis. This critical pathway basis of comparison for SCDHEC detected dose results from accumulated releases that are deposited within 50-miles of an SRS center-point and radionuclide decay (Table 6 and Figure 3, Section 5.1.2). This figure illustrates the dominance of the atmospheric pathway (15.45 mrem) over the liquid pathway (5.65 mrem) on an average dose basis and the shift in percentages that occur when the deer maximum dose is substituted for the deer average dose. The food ingestion pathway (FP) was the primary contributor to dose (12.48 mrem), the direct exposure pathway (DXP) second (7.21mrem), the nonpotable surface water pathway (NPS) third (0.88 mrem), the public water systems drinking water pathway fourth (PWSDW)(0.46 mrem), and the direct inhalation pathway fifth (IP)(0.06 mrem).

The Liquid Pathway

The liquid pathway contributed dose to the individual through the inhalation (e.g., resuspension of dried riverbank sediment), ingestion (public water supplies, groundwater, surface water, rainwater, and fish), and direct exposure routes. The potential NORM dose from All-Sources in 2007 was 2.609 mrem and added to the average observed dose (Table 1, Section 5.1.2). Riverbank sediments are an example of a media that can impact both atmospheric (through inhalation of resuspended dry sediments) and liquid pathways (through ingestion and direct contact) dependent on how the exposure occurred.

The SCDHEC detected dose potential from the liquid pathway media totaled 0.656 mrem (uses highest drinking water dose) in 2007 (Table 1, Section 5.1.2). The highest detected dose from the MEI liquid pathway in 2007 was mostly from Cs-137 in fish (0.324 mrem), unknown alpha

in nonpotable surface water at boat landings (0.114 mrem) and Cs-137 in riverbank sediments at boat landings (0.112 mrem), unknown alpha and Cs-137 direct exposure in sediments (wading) at Fourmile creek mouth (0.059 mrem), unknown beta and tritium in river water public water supplies (0.020 mrem), tritium in groundwater public water supplies (0.010 mrem), tritium in rainwater cisterns (0.014 mrem), and the remainder was less than 0.005 mrem for any other liquid dose media (Table 1, Section 5.1.2). The AvgNORM column contributions to the liquid pathway totaled 0.936 mrem with most of the dose coming from Ra-226 and Pb-214.

The maximum limit or upper bound (MaxRACx column) for the liquid dose potential based on exposure to the single highest media maximums for the entire year was 1.945 mrem, and 1.200 mrem additional NORM for a liquid pathway upper bound total of 3.145 mrem (Table 1, Section 5.1.2). The addition of an upper bound calculation illustrates that the MEI liquid exposure could not be greater than 3.145 mrem for any scenario in 2007 based on sample media maximum detections, which is well under the DOE-SR limit of dose to the public (100 mrem). This should not be compared to the liquid pathway 4-mrem dose limit since the upper bound is based solely on single maximum detections from different sources and all at the same maximum consumption rate. A maximum consumption for water can occur only once since it is not proportioned out among drinking water sources. This upper bound illustrates that the DOE-SR 100-mrem limit could not have been exceeded for both pathways combined (3.145 mrem liquid pathway upper bound plus 16.204 mrem atmospheric pathway upper bound) equal 19.349 mrem.
The 1999-2007 liquid pathway dose (5.65 mrem) was 26.77 % of the average dose (Table 6, Section 5.1.2). Exposure from public water supplies (0.46 mrem) during the nine-year period was 2.16 % of the average dose, and nonpotable pathways accounted for 4.19 % of the average dose.

The SCDHEC detected liquid media dose averages for 1999-2007, in order, were as follows: fish 0.49 (± 0.26 mrem), median 0.44 mrem; surface water at boat landings, 0.06 (± 0.03) mrem, median 0.06 mrem; DNR groundwater wells 0.05 (± 0.06) mrem, median 0.02 mrem; public water suppliers of river water, 0.03 (± 0.02) mrem, median 0.03 mrem; public water from groundwater wells, 0.02 (± 0.02) mrem, median 0.01 mrem; and rainwater, 0.01 (± 0.01) mrem, median 0.01 mrem (Table 1, Section 5.1.4).

The SCDHEC and DOE-SR Liquid Pathway Comparison

SCDHEC detected less soil exposure dose (0.43 mrem) for the sportsman than estimated by DOE-SR (2.90 mrem) due to the sampling of riverbank soil versus swamp sediments, respectively, in different locations. A comparison of media categories with DOE-SR gave similar averages that were within one standard deviation of either average for SCDHEC 0.91 (± 1.48 mrem) and DOE-SR 1.28 ± (1.46 mrem), (Table 2, Section 5.1.2). Most of the liquid pathway difference was due to Cs-137 in fish, and unknown alpha detections in boat landing surface water (Data Tables, Section 5.1.3). Dose uptake after bioconcentration of Cs-137 in fish and deer is the dominant route of exposure to the public via the food pathway, whether of atmospheric or liquid pathway origin.

Many years of cumulative dose releases contribute to the dose detections in any given year and make potential dose releases versus detections indirectly comparable. The detected exposure in millirems is a more meaningful indicator of dose to the public versus percentages.

The DOE-SR liquid medium contributes to the food, surface water, groundwater, and sediment exposure pathways (Figure 1, Section 5.1.2). Cesium-137, unknown beta, unknown alpha, and tritium (in that order) account for the majority of the total potential committed dose to the MEI from DOE-SR liquid releases in 2007 (WSRC 2008a). The DOE-SR calculated dose to the fish pathway was 51 % of the liquid releases in 2007 (Table 3, Section 5.1.2)(WSRC 2008a). The DOE-SR calculated dose to the water pathway was 49 % of the liquid releases in 2007. The DOE-SR calculated dose to the ground pathway was 3.8 % from atmospheric releases and may contribute to the liquid pathway.

These DOE-SR release estimates (51.0 % fish) were in contrast to actual SCDHEC detections that impacted the public in 2007 (Table 3, Section 5.1.2)(Table 1, Section 5.1.2). For example, the 0.324 mrem fish dose was 32.11 % of the perimeter average dose (0.324/1.009 mrem*100%) excluding NORM, and changed to 20.54% using only maximum detections (1.166/5.677 mrem*100%)(Table 1, Section 5.1.2). However, lower detections were expected since not all releases result in media absorption. The SCDHEC order of detected radionuclide dose in the 2007 liquid pathway excluding assigned NORM was Cs-137 in fish, unknown alpha in Savannah River water, unknown alpha in sediments, tritium in rainwater, unknown beta in Savannah River water, tritium in groundwater water, Cs-137 in sediments, and tritium in Savannah River water (Data Tables, Section 5.1.3). Thus, the bioconcentrated radionuclides, primarily Cs-137 in the food pathway, were the major contributors to dose.

The All-Pathway SCDHEC and DOE-SR Comparison

The All-Pathway dose basically represents exposure from the airborne and liquid pathways for the general public who are not subject to increased exposure from other activity (e.g., farmer or sportsman). Table 7 of Section 5.1.2 compares DOE-SR and SCDHEC primary dose contributions in 2007 from the combined liquid and airborne pathway, and from the sportsman pathway (WSRC 2008a). The average liquid and airborne pathways near the site boundary were close at 0.10 mrem (DOE-SR) and 0.12 mrem (SCDHEC). Most of the dose detected by SCDHEC was unknown alpha and the assignment of Pu-239 to this alpha biases the estimate high. The unknown alpha could be in part or wholly NORM. Consideration of the potential dose on a single maximum detection basis would increase the tritium dose at the site boundary through drinking nonpotable water to 0.20 mrem tritium and 0.27 mrem unknown alpha plus unknown beta (Data Tables, Section 5.1.3). SCDHEC ESOP detections in 2007 for the general public scenario added milk, edible vegetation, and recreational swimming to the air and public water supply dose to total 0.16 mrem (Table 5, Section 5.1.2). If the nonpotable drinking water dose of 0.11 mrem were added in place of the public water system dose, the total would be 0.25 mrem. The primary difference in dose was due to a single detection of Sr-89/90 in soybeans that may represent past years accumulation at that location. This single detection (0.13 mrem) representation of a yearly dose by SCDHEC (protective) was biased high due to dose based on detections only and the exclusion of nondetections in soybeans in determining the average dose. The remainder of the known radionuclide dose (0.03 mrem) was mostly tritium in public water supplies. The unknowns were assigned dose, but could be potential NORM. The higher

SCDHEC dose (0.25 mrem) is 0.25 % of the 100-mrem/yr DOE dose standard. Thus, the general public received dose in 2007 that is typically far less than that received from watching TV (1 mrem), (Figure 2, Section 5.1.2). The DOE-SR 2007 All Pathway dose of 0.10 mrem was within one standard deviation of the SCDHEC 1999-2007 dose to the public, which averaged 0.12 (± 0.09) mrem with a median of 0.09 mrem (Table 5, Section 5.1.2). The median reduces the influence of outliers in a large environmental data set and may be a better indicator of the central tendency.

The Food Pathway SCDHEC and DOE-SR Comparison

Unknown variables cause fluctuation in the deer dose, but weather and related forage availability may have played a role especially in bioconcentrators (e.g., mushrooms). The highest known bioconcentrators of Cs-137 are mostly bolete fungi that fruit primarily in August and September (Botsch 1999). Deer and other animals that consume boletes could potentially receive the highest dose no later than October in the most productive years. Inclusion of the single worst-case or maximum deer dose (2.66 mrem) instead of the average deer dose (0.00 mrem) in 2007 resulted in a very different dose that could occur only for the one hunter who killed and ate the most contaminated deer sampled. However, SCDHEC adds the single worst-case deer consumption by a single hunter to all other detected dose (Maximum Deer scenario) as protective for the potential worst-case minority, the survivalist who may consume all of the maximally contaminated deer (Table 5, Section 5.1.2). All food maximums together would add 3.973 mrem of potential dose to the average perimeter dose of 1.010 mrem (Table 1, Section 5.1.2) for a total of 4.983 mrem. This food maximum in 2007 was 69.98 % of the all maximum potential dose (3.973/5.677*100%). The all food percent contribution 45.54 % (0.46 mrem/1.01*100%) on an average instead of a maximum basis was still the dominant contributor to dose.

The 2007 SCDHEC maximum food pathway dose for deer was 2.660 mrem, fish (1.166 mrem), edible vegetation (0.132 mrem), and milk (0.015 mrem) (Table 1, Section 5.1.2). The 1999-2007 sportsman food dose (deer, hog, fish) versus the nonsportsman or general food (milk, edible vegetation) categories were very different (Table 8, Figure 8, Section 5.1.2) (Table 1, Section 5.1.4). The nine-year maximum (fish, deer, hog) dose averaged 10.36 mrem ± a standard deviation of 11.36 mrem with a median of 8.26 mrem. Compare this to the minimum food dose, which was 0.08 (± 0.08) mrem with a median of 0.05 mrem (milk, edible vegetation). Sportsman food becomes the obvious the major media responsible for potential dose to the public. Sportsman food in 2007 was at a maximum 79.11 % (3.826/4.836 *100%) of the dose to the general public who was not a sportsman, but ate game that was given to them by a hunter friend (Table 1, Section 5.1.2). Nongame dose represents a relatively small percent (7.93 % or 0.08/1.009*100%) of the minimum dose to the public. Table 8 of Section 5.1.2 includes two substitution examples that indicate how the general public food dose would increase in 2007, if one happened to eat the worst-case deer (goes from 1.01 to 3.67 mrem for deer) and fish dose (increases the total to 4.52 mrem) detected in SCDHEC samples. While it is possible to eat 48.2 kilograms (consumption factor that was used) of edible fish tissue, the probability is low to catch that many fish and for all fish caught to contain the same contamination and quantity that was found in the one worst-case fish. This is just one example of why any dose based on single maximums is biased very high on a practical basis. However, note from Table 1, Section 5.1.2, the total for all maximums was only 5.677 mrem on an inflated dose basis, and this dose is well below the 100-mrem dose limit to the public allowed for DOE-SR (WSRC 2008a). Even the

addition of all detected dose including NORM maximums would not give a dose greater than 19.349 mrem based on SCDHEC sample detections (Table 1, Section 5.1.2).

The DOE-SR comparable food doses in 2007 were offsite MEI deer consumption (1.90 mrem), creek mouth fisherman (0.24 mrem), vegetation (0.0167 mrem), and milk (0.00459 mrem) for a total of 2.161 mrem of comparable food dose (WSRC 2008) versus 3.120 mrem total for SCDHEC (2.660+0.324+0.132+0.004 respectively)(Table 1, Section 5.1.2). The 2007 sportsman dose (deer and fish) for DOE-SR was 2.14 mrem versus 2.98 mrem for SCDHEC (Table 7, Section 5.1.2). Compare this to the 1999-2007 SCDHEC Average Sportsman food dose of 2.27 (± 1.71) mrem with a median of 1.72 mrem (Table 5, Section 5.1.2). Note that both DOE-SR and SCDHEC 2007 food dose estimates were within approximately two standard deviations of the nine-year average food dose 1.39 ± (1.63) mrem for SCDHEC (Table 8, Section 5.1.2). This implied that DOE-SR and SCDHEC were detecting the same radionuclide population.

The sportsman food difference between the two agency averages was primarily dependent upon the highest deer dose. The 2007 nonsportsman milk and edible vegetation food was 0.021 mrem for DOE-SR (WSRC 2007) versus 0.136 mrem for SCDHEC (Table 8, Section 5.1.2). Compare this to the SCDHEC nine-year average for nonsportsman food 0.08 mrem ± 0.08 with a median of 0.05 mrem. The 2007-year DOE-SR nonsportsman food average (0.021 mrem) and the SCDHEC nonsportsman food dose (0.136 mrem) were within one standard deviation of the SCDHEC nonsportsman food 1999-2007 average (Table 8, Section 5.1.2). A single nontypical vegetation result came from Sr-89/90 in soybeans and illustrates the influence of a single extreme on an average, and actually represents in this case an upper bound based on a single maximum and not an average. Figure 8 of Section 5.1.2 compares the statistics for the average sportsman, nonsportsman, the all-food total, and the maximum deer example. The median may be a better measure of the central tendency. SCDHEC averages only detected results above a minimum detectable activity (MDA), and biases the dose high (protective) compared to the low dose that would result if the many nondetections were averaged in at some value of the MDA, such as 0.5MDA. However, both DOE-SR and SCDHEC food dose results compare favorably based on the nine-year food dose average and standard deviations, whether sportsman, nonsportsman, or combined food (Figure 4, Section 5.1.2).

The SCDHEC MEI deer dose was from Cs-137 (2.66 mrem) for the single hunter who consumed the worst-case deer. The maximum deer dose (worst-case) was always higher in any year compared to the average deer dose (0.00 mrem in 2007). ESOP food dose averages (Table 1, Section 5.1.4) above a South Carolina background indicated that hog (sampled in fewer years and with few samples) was highest with an average of 1.53 (± 1.87) mrem, and 0.97 mrem median for the collection years 2000-2002. This hog result may be biased high due to chance. Fish was second (sampled 1999-2007) with a food average ingestion dose of 0.49 (± 0.26) mrem, and 0.44 mrem median (Table 1, Section 5.1.4). The fish dose average exposure (0.324 mrem in 2007) was based on the total for the highest dose per radionuclide, since the MEI was assumed to eat all fish. The DOE-SR 2007 year creek mouth fish result of 0.24 mrem was within one standard deviation of the SCDHEC 1999-2007 average. Average deer (sampled 2000-2007) dose was third with 0.34 mrem average (± 0.49), and 0.15 mrem median.

The MEI (single worst-case hunter) hog average dose (2000-2002) for the years collected was 7.08 (± 8.81) mrem, and 4.29 mrem median (Table 1, Section 5.1.4). The MEI deer average dose (2000-2007) was 8.45 (± 6.47) mrem with a 6.91 mrem median, possibly due to the greater number of samples collected. However, the maximum deer dose was always higher than the fish dose in any year. The dose rank for deer, hog, and fish changes when comparing average dose values versus the maximum dose values. However, Cs-137 was the major contributor to dose across all three media.

The DOE-SR milk dose of 0.005 for cow milk was within one standard deviation of the SCDHEC milk dose 0.06 (± 0.08) mrem, and 0.04 mrem median (Table 1, Section 5.1.4). Vegetables were fifth at 0.03 (± 0.05) mrem, and 0.01 mrem median. The nonsportsman food (milk and vegetables) average dose 0.08 (± 0.08) mrem, and 0.05 mrem median was much lower than the sportsman food (fish, deer, hog) average dose 10.36 (± 11.36) mrem and 8.26 mrem median. The median may be a more accurate central tendency indicator than the average for large amounts of data, since the influence of extremes is less.

The percent contributions to the perimeter average dose in 2007 were 0.20 % inhalation, 59.41 % ingestion, and 40.39 % direct exposure (Table 1, Section 5.1.2). However, the maximum ingested food dose, sportsman and nonsportsman was 3.973 mrem or 69.98 % (3.973/5.677*100%) of the total maximum dose, and the maximum deer dose (2.66 mrem) was 66.95% (2.660/3.973*100%) of the total food dose in 2007.

The DOE-SR potential dose from irrigation pathways (0.05 mrem) was 0.047 mrem for vegetables, 0.0050 mrem for milk, and 0.0016 mrem for meat. This is an increase in dose compared to the cow milk MEI air pathway (0.0167 mrem for vegetables, 0.0046 mrem for milk, and 0.0019 mrem for meat) (WSRC 2008a). The greatest influence was an increase in vegetable dose from the irrigation pathway (approximately 0.03 mrem). Cesium-137 was the only gamma source detected in food products (cabbage and wheat) in 2007. Gross beta was detected in all food products, tritium in collards, U-234 in fruit and beef, uranium-238 in beef, Pu-238 in beef and cabbage, Pu-239 in beef and cabbage, and Am-241 in wheat (WSRC 2008a).

Only tritium (in collards, mustard, watermelon, peaches) and Sr-89/90 (soybeans) were detected in SCDHEC samples. However, only tritium in two leafy vegetables (collards and mustards) and Sr-89/90 in a single soybean sample were above the South Carolina background values. Edible vegetation in SCDHEC samples averaged 0.03 (± 0.05) mrem with a median of 0.01 mrem from 2002-2007. Thus, the DOE-SR edible fruit and leafy dose maximum was from the irrigation pathway (0.047 mrem) and was within one standard deviation of the SCDHEC six-year average (Table 1, Section 5.1.4). SCDHEC does not sample food media within DOE-SR.

The SCDHEC Dose Scenarios

Table 5 and Figure 5 of Section 5.1.2 summarizes three different scenarios (Public, Farmer, Average Sportsman) for public exposure based on lifestyle potential exposures via applicable media. Additional NORM detections and media maximums in 2007 may be added to any of these basic scenarios to determine a personal scenario not covered by these examples. However, the comparable average value must be subtracted from the new total for any maximum that is

substituted. For example, Table 5 of Section 5.1.2 illustrates adding the deer maximum (2.66 mrem) and subtracting the average deer (0.00 mrem) to obtain the new total (3.67 mrem) that would apply to the average nonsportsman who may eat all of the worst-case deer contamination donated by a friend. This process can be done for any maximum, such as fish, to obtain a new total provided that the corresponding average value is subtracted (Table 1, Section 5.1.2). The corresponding NORM dose maximums may be substituted for the NORM dose average values if the potential total dose from All-Sources detected is desired. A fifth scenario is actually an upper bound (19.349 mrem) based on the single highest detection for each media with the assumption this dose is constant for the entire year (Data Tables, Section 5.1.3). This doesn't represent an actual potential dose due to temporal factors, a lack of proportioning for competing sources, and probability of consumption at maximum levels and rates. However, the upper bound serves to determine if the 100-mrem DOE-SR dose limit could have possibly been exceeded based on the current year's samples. DOE-SR did not exceed this limit under any possible scenario based on SCDHEC samples upper bound detections.

The general Public dose scenario potential exposure includes the average dose above background detected by air filters, edible vegetation, milk, and the highest public water supply dose. This scenario is for the nonsportsman who is not exposed to forest soils, sediments, game, or other water dose in remote locations. Table 5 of Section 5.1.2 shows that the 2007 Public dose was 0.16 mrem and the 1999-2007 Public dose averaged 0.12 (± 0.09) mrem with a median of 0.09 mrem.

The Farmer dose scenario potential exposure includes the average dose above background detected by TLD, air filters, edible vegetation, milk, soil, sediments, and the highest groundwater supply dose. This scenario is for the nonsportsman farmer who is not exposed to game or other water dose in remote locations. Table 5 of Section 5.1.2 shows that the 2007 Farmer dose was 0.58 mrem and the 1999-2007 Public dose averaged 0.92 (± 1.19) mrem with a median of 0.15 mrem.

The Average Sportsman dose scenario potential exposure includes the average dose above background detected by TLD, air filters, edible vegetation, milk, fish, soil, sediments, average deer and hog, and the single highest potential drinking water exposure. Table 5 of Section 5.1.2 shows that the 2007 Average Sportsman dose was 1.01 mrem and the 1999-2007 Average Sportsman dose was 2.27 (± 1.71) mrem with a median of 1.72 mrem.

Should any of the above scenarios not represent a lifestyle, a fourth or individual lifestyle scenario can be calculated from Table 1, Section 5.1.2 by simply substituting any maximum for the corresponding average value whether it is a nonNORM radioactivity concentration that excludes NORM (RACx) or a NORM calculation. This lifestyle dose would be the MEI for that lifestyle. Note that if all maximums are substituted for all average values, the dose limit for any lifestyle excluding NORM is 5.677 mrem. If you substituted the NORM maximums for all NORM average values, the additional dose limit would be 13.077 mrem for a total of 18.754 mrem from all maximum NORM and maximum RACx detections. Recall from previous discussions that this dose may be inflated by over 100 % mostly due to the assignment of unknowns as RACx dose at the highest possible dose. Even the perimeter average dose was

inflated by the same factors and may actually be less than half of the 1.009 mrem protective calculated dose.

The fifth scenario is a Maximum or Upper Bound dose limit, which is based on the single highest maximum detection in each media above background calculated as a constant dose for the entire year. This does not represent a practical scenario since a single person could not be present in all of the locations on a temporal basis to receive the maximum dose from all media at the maximum consumption rate. Thus, the All-Source maximums represent an upper dose limit (19.349 mrem) not expected to be achieved by any member of the public, but present in the media sampled at some point within the year. Note that there would be no standard deviation and the median and average are the same for an unvarying maximum maintained for a period of one year. A further check on the upper bound limit was achieved by adding DOE-SR detected dose that was not sampled by SCDHEC. The addition of the SCDHEC AvgRACx dose of 1.009 mrem and the MaxRACx dose of 5.677 mrem to DOE-SR media dose not sampled by SCDHEC gave a revised maximum potential that included other sources. Table 7 of Section 5.1.2 summarizes the DOE-SR and SCDHEC dose sources that can be used to calculate a revised maximum based on other agency data. The onsite hunter dose (9 mrem), the offsite hog dose (2.30 mrem), the difference in the soil maximum (2.90 minus 0.43 mrem or 2.47 mrem), and 0.17 mrem additional fisherman soil exposure added 13.94 mrem of potential dose to any SCDHEC scenario. This increases the average dose for the sportsman who takes place in SRS hunts from 1.009 mrem (average basis) to 14.949 mrem, and increases the maximum from 5.677 mrem to 19.62 mrem (Tables 1 and 5, Section 5.1.2). Note the revised average to maximum range (14.95 to 19.62 mrem) was within the first standard deviation of the 1999-2007 sportsman maximum food dose of 10.36 (± 11.36) mrem (Table 8, Section 5.1.2). These maximum dose potentials from SCDHEC and DOE-SR combined confirms that the MEI and public under any scenario was not exposed to dose greater than the DOE-SR dose limit of 100 mrem/yr. DOE-SR monitors individual hunters on the SRS to ensure that they do not exceed the DOE 100 mrem standard (WSRC 2003a). Thus, both programs appear to be sampling the same dose population despite differences in locations, methods, and analyses. Table 4 of Section 5.1.2 statistics that were derived from DOE-SR release dose estimates were all higher than the actual exposures measured by SCDHEC. This illustrates that all releases do not result in public exposure especially when potential dose accumulation over several years is considered.

CONCLUSIONS AND RECOMMENDATIONS

The survivalist-sportsman MEI scenario should include all potential dose as a worst-case scenario. The SCDHEC detected worst-case dose received that excludes possible NORM above the South Carolina background was 5.677 mrem in 2007. Additional dose added primarily for DOE-SR onsite estimates for sportsmen increased the total offsite potential dose to 7.98 mrem and the combined onsite and offsite dose potential to 19.62 mrem for the MEI. This maximum potential confirms that the DOE-SR 100 mrem dose limit to the public was not exceeded in 2007.

Three dose scenario estimates were calculated based on SCDHEC data from 1999 to 2007. The average sportsman who was not the MEI was exposed to 1.01 mrem of dose in 2007 and averaged 2.27 (±1.71) mrem with a median of 1.72 mrem for 1999-2007. The farmer, who was not a hunter, but inhaled, ingested, or received direct exposure from soil received a dose of 0.58

mrem in 2007 and averaged 0.92 (±1.19) mrem with a median of 0.15 mrem from 1999-2007. The general public who was not a sportsman and was not exposed to swamp soils received less than 0.16 mrem of dose in 2007 and averaged 0.12 (±0.09) mrem with a median of 0.09 mrem for 1999-2007.

Most of the 1999-2007 average dose was the result of atmospheric deposits (73.23 %) and the balance was from the liquid route (26.77 %). The sportsman pathway contributed the greatest dose to the public from 1999 through 2007 primarily through food ingestion dose (59.14 %) from game animal and fish consumption of cesium-137. The second highest dose pathway was due to direct exposure (34.20 %) primarily from soil ambient beta-gamma, unknown alpha, and unknown beta. Nonpotable water consumption, primarily river water, was the third major pathway (4.19 % of dose) with radium-226 as the main contributor to dose, potable public water supply sources were fourth (2.16 % of dose) due to tritium and unknown beta, and inhalation was fifth at 0.30 % of the dose primarily from unknown alpha. Nonsportsman food (milk and vegetables) averaged 0.08 (± 0.08) mrem with a median of 0.05 mrem. The main nonNORM radionuclide dose contributors from 1999 through 2007 were Cs-137 (14.35 mrem), tritium (0.67 mrem), and Sr-89/90 (0.58 mrem). Unidentified alpha (7.13 mrem), beta-gamma (6.69 mrem), and Ra-226 (4.85 mrem) were the main NORM contributors to dose.

The SCDHEC 2007 maximum atmospheric (0.006 mrem) and liquid (0.445 plus 0.031mrem) dose estimates based on single maximum dose detections per applicable media were well within the respective 10 mrem and 4 mrem DOE limits. Inhalation was 0.20 % of the dose to the critical pathway, ingestion was 59.41 %, and direct exposure was 40.39 % in 2007.

The SCDHEC Critical Pathway Dose Project will continue to monitor the MEI dose trends. SCDHEC expanded the ESOP environmental program in 2004 by adding random SRS perimeter and South Carolina background samples to improve statistical comparisons. ESOP has increased sampling near the perimeter of SRS and in closer proximity to SRS storage tanks, basins and seepage areas to ensure an early warning for any contaminant making its way to the SRS streams.

Potential atmospheric and liquid release concerns that may play a relatively larger role in the dose to the surrounding public in the future may include the following:

- releases of Am-241, plutonium and uranium radionuclides from the Mixed Oxide Fuel Fabrication Facility (MFFF) through the air and surface water environmental mediums (Duke, COGEMA, Stone, & Webster 1998);
- computer models predict a high concentration of tritium migrating from the Old Radioactive Waste Burial Ground (ORWBG) to Upper Three Runs (WSRC 2001) and/or the Savannah River;
- radionuclides such as carbon-14 (C-14), I-129, neptunium-237 (Np-237) and technetium-99 (Tc-99) may be an ORWBG contaminant to monitor in the future because of their long half-lives.
- potential dose from the new Mixed Oxide (MOX) facility operations.

These findings indicated that environmental monitoring programs should focus on bioconcentrators of dose in the sportsman food, swamp sediments and soil (direct exposure, ingestion, and resuspension), other food, drinking water, and air exposure pathways. The down-gradient wells, surface water, sediments, plants, and animals should be carefully monitored for any signs of the contaminants that are present at tank farms, basins, and seepage areas. Early detection is paramount to protecting the public and the environment if a release to offsite streams or groundwater occurs. Increased background and SRS perimeter sampling by SCDHEC started in 2004, and should improve the evaluation of background and perimeter concentrations. SCDHEC will continue to monitor the SRS and adjacent area for the primary radionuclide contributors to dose associated with DOE-SR operations.

Back to Table of Contents

Section 5.1.2 Tables and Figures

Table 1. 2007 SCDHEC Dose (mrem) Estimates for Pathways, Exposure Routes, and Media

Pathways	Routes	Media	AvgRACx[1]	AvgNORM[2]	MaxRACx[3]	MaxNORM[4]
APW	Inhalation	Air (filters)	0.002	NA	0.004	NA
APW	Inhalation	Resuspended Soil	NA	1.436	NA	4.156
LPW	Inhalation	Resuspended Riverbank Sediment	0.000	0.000	0.002	0.000
%	0.198	**Air Inhalation Totals**	**0.002**	**1.436**	**0.006**	**4.156**
LPW	Ingestion	Fish	0.324	NA	1.166	NA
APW	Ingestion	Deer	0.000	NA	2.660	NA
APW	Ingestion	Hog	NA	NA	NA	NA
APW	Ingestion	Vegetable	0.132	NA	0.132	NA
APW	Ingestion	Milk	0.004	NA	0.015	NA
APW	Ingestion	Soil	0.024	0.041	0.109	0.215
LPW	Ingestion	Riverbank Sediments	0.001	0.001	0.004	0.002
%	48.067	**Food Ingestion Dose Totals**	**0.485**	**0.042**	**4.086**	**0.217**
LPW	Ingestion	PWS River Water	0.020	NA	0.056	NA
LPW	Ingestion	PWS Wells	0.010	0.006	0.014	0.006
LPW	Ingestion	DNR Wells	0.000	*0.476*	0.000	0.497
LPW	Ingestion	SR Water at Boat Landings	*0.114*	NA	*0.445*	NA
LPW	Ingestion	Rainwater	0.014	NA	0.022	NA
LPW	Ingestion	Swimming Ingestion	*0.001*	NA	*0.031*	NA
%	11.397	**All DW Ingestion Dose Totals**	**0.159**	**0.482**	**0.568**	**0.503**
APW	Direct	Submersion (Cloud)	NA	NA	NA	NA
APW	Direct	Absorption (Skin)	NA	NA	NA	NA
LPW	Direct	Immersion (Swimming)	0.000	NA	0.000	NA
LPW	Direct	Sediment Wading (Skin)	0.059	0.407	0.059	0.423
APW	Direct	Ground (Shine)	0.236	0.196	0.904	1.009
APW	Direct	TLD Beta-gamma	NA	0.000	NA	7.000
LPW	Direct	Riverbank (Shine)	0.112	0.046	0.146	0.272
%	40.337	**All Direct Exposure Dose Totals**	**0.407**	**0.649**	**1.109**	**8.704**
All-Sources Dose (Upper Bound of Detections) Totals			1.053	2.609	5.769	13.580
Perimeter Dose (Applicable Media) Totals[7]			***1.009***	**2.603**	***5.677***	**13.077**
Examples of maximum dose additions to the average results.						
Examples of substituting avg dose with maxima.	Add Max Deer Hunter to Avg Dose		**3.669**	from (1.009+2.660-0.000)		
	Add Max Fish to the Deer Hunter		**4.511**	from (3.669+1.166-0.324)		
MEI (MaxRACx plus MaxRACxNORM) Applicable Dose[7].			**18.754**			
All Sources Maximums (**Upper Bound of Detections)** Total[8].			**19.349**			
The Atmospheric Pathway (**APW**) Upper Bound Dose			0.398	1.673	3.824	12.380
The Liquid Pathway (**LPW**) Upper Bound Dose			0.655	0.936	1.945	1.200
Primary Critical Pathways Percent Contribution			Average Dose Basis		Maximum Dose Basis	
Atmospheric (APW) and Liquid (LPW) Pathways			APW %	LPW %	APW %	LPW %
Percentage Totals for Perimeter Dose			37.797	62.203	66.285	33.715

Notes:

1 - AvgRACx is the **average r**adionuclide **a**ctivity **c**oncentrations above background e**x**cluding **NORM**.

2 - AvgNORM is the **average NORM** radionuclide activity concentration above background.

3 - MaxRACx is the single highest (**max**imum) **r**adionuclide **a**ctivity **c**oncentration e**x**cluding **NORM**.

4 - MaxNORM is the single highest (**max**imum) **NORM** radionuclide activity concentration.

5 - **NORM** is naturally occurring radioactive material not assignable to SRS.

6 - See acronym list for abbreviation definitions not listed.

7 - The maximum consumption rate can only be used with one drinking water (DW) source (highest underlined).

8 - Proportioning of consumption rates among all drinking water maximums would reduce this dose total.

Table 2. SCDHEC and DOE-SR Comparable Media Dose for the MEI

Environmental Monitors - 2007	SCDHEC				DOE-SR (1)			
Pathways by Media	**Air**	**Liquid**	**Soil**	**Food**	**Air**	**Liquid**	**Soil**	**Food**
MEI liquid	NA	0.11	NA	NA	NA	0.05	NA	NA
Inhalation* (2)	0.00	NA	NA	NA	0.04	NA	NA	NA
Combined Soil* (3)	NA	NA	0.43	NA	NA	NA	2.90	NA
Swimming	NA	0.00	NA	NA	NA	0.00	NA	NA
Boating	NA	0.00	NA	NA	NA	0.00	NA	NA
Milk	NA	NA	NA	0.00	NA	NA	NA	0.00
Edible Vegetation	NA	NA	NA	0.13	NA	NA	NA	0.00
Creek Mouth Fish	NA	NA	NA	0.32	NA	NA	NA	0.24
Offsite MEI Deer	NA	NA	NA	2.66	NA	NA	NA	1.90
Totals	0.00	0.11	0.43	3.11	0.04	0.05	2.90	2.14
2006 MEI Comparison	**Pathways Excluding NORM**				**Summary Statistics**			
Totals	**Air**	**Liquid**	**Soil**	**Food**	**Totals**	**Avg.**(4)	**SD**(5)	**Median**
SCDHEC	0.00	0.11	0.43	3.11	3.65	**0.91**	1.48	0.27
DOE-SR	0.04	0.05	2.90	2.14	5.13	**1.28**	1.46	1.10
Averages per column	**0.02**	**0.08**	**1.67**	**2.63**	**4.39**	**1.10**	**1.47**	**0.68**
Standard Deviation	0.03	0.04	1.75	0.69	1.05	0.26	0.01	0.58
% of standard (6)	**0.10**	**2.00**	NA	NA	NA	NA	NA	NA

Notes: These comparisons are for media detections of possible nonNORM to evaluate SCDHEC actual detections compared to potential dose calculated by DOE-SR.

1. The DOE-SR estimates of dose to the MEI come from the Savannah River Site Environmental Report for 2007, WSRC-TR-2007-00008 detections.
2. SCDHEC combined soil reflects dose from soil resuspension alpha & beta assignable as Pu-239 and Sr-90.
3. The DOE-SR combined soil reflects dose from combined inhalation and ingestion of swamp and creek mouth soils. SCDHEC dose is from all soil and sediment excluding NORM.
4. Avg is average.
5. SD is standard deviation.
6. Percent (%) of DOE air (10-mrem) and liquid (4-mrem) standards from the DOE-SR and SCDHEC averages.

Table 3. DOE-SR Percent of Total Dose to the MEI for Atmospheric and Liquid Releases

MEI from Atmospheric Releases (MAXIGASP-SR Code) Percent of Total Dose

DOE-SR	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Plume	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.4	0.5	0.2	0.4	0.0	0.0	0.0	0.0
Ground	0.2	0.2	3.6	1.6	1.8	1.1	1.0	1.7	0.7	2.1	1.7	1.6	2.3	6.4	3.8
Inhalation		47.7	44.1	38.5	41.9	42.6	48.3	45.7	42.6	41.0	33.5	43.4	42.7	41.6	41.1
Vegetation	26.5	35.2	36.7	40.0	37.8	41.8	44.4	41.9	44.1	44.5	51.9	39.4	40.7	46.3	39.6
Cow Milk	8.3	12.0	11.2	11.6	10.7	10.4	4.6	7.3	9.0	9.1	9.6	11.3	10.3	1.5	10.9
Meat	3.5	5.0	4.5	8.2	7.8	4.0	1.7	2.9	3.2	3.2	2.9	4.4	4.0	4.3	4.6

Cow Milk Pathway

1993-2007	Avg	SD	Median
Plume	0.1	0.2	0.0
Ground	2.0	1.6	1.7
Inhalation	42.5	3.7	42.6
Vegetation	40.7	5.7	40.7
Cow Milk	9.2	2.9	10.3
Meat	4.3	1.7	4.0

MEI from Liquid Releases Percent of Total Dose

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Fish	54.1	50.7	49.9	46.7	39.9	50.3	61.0	45.8	40.2	42.5	55.4	47.0	59.0	59.0	51.0
Water	45.7	49.2	50.0	53.2	60.0	49.6	38.5	53.9	59.5	57.2	44.2	53.0	41.0	41.0	49.0
Shoreline	0.2	0.0	0.0	0.1	0.0	0.2	0.4	0.3	0.3	0.3	0.4	<1	<1	<1	<1
Swimming	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1	<1	<1	<1
Boating	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1	<1	<1	

Potential MEI Dose from the Liquid Releases

1993-2007	Avg	SD	Median
Fish	50.2	6.7	50.3
Water	49.7	6.7	49.6
Shoreline	0.2	0.1	0.2
Swimming	0.0	0.0	0.0
Boating	0.0	0.0	0.0

Notes: See the list of acronyms for abbreviation definitions.

Data accumulated from the SRS Environmental Reports (WSRC) for the listed years.

Table 4. DOE-SR Committed Dose (mrem) for MEI and Sportsman Pathways (DOE-SR)

Path / Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
All Pathway		0.23	0.2	0.19	0.18	0.19	0.28	0.18	0.18	0.18	0.19	0.15	0.13	0.2	0.1
Onsite Hunter	57.3	46	30	21	26	56	77	63	14	39.5	15.6	70.8	8.8	22	9
Offsite Hunter	4.1	20	15	14	14	12	9.1	10.1	0.53	12.15	1.2	17.3	8.3	9.6	4.8
Offsite Fisherman	1.3	1.3	1.2	1.7	0.65	1.6	0.61	1.18	1.74	0.62	0.66	0.71	0.52	0.52	0.5

1. Empty cells indicate no data reported.
2. Data from tables in all WSRC referenced reports.

	Statistics		
1993-2007	Avg	SD	Median
All Pathway	0.184	0.042	0.185
ONS Hunter	37.07	23.14	30
OFS Hunter	10.15	5.679	10.1
OFS Fisherman	0.987	0.461	0.71

Notes: See the list of acronyms for abbreviation definitions.

Data accumulated from the SRS Environmental Reports (WSRC) for the listed years.

Table 5. Dose Scenarios and MEI Estimates

Scenarios in Millirem of Exposure	2007	1999-2007		
	Avg.	Avg.	SD	Median
Public[1]	0.16	0.12	0.09	0.09
Farmer[2]	0.58	0.92	1.19	0.15
Average Sportsman[3]	1.01	2.27	1.71	1.72
Additional NORM[4]	2.60	1.37	1.43	1.20
DOE-SR additions for the onsite sportsman.[5]				
Combined DOE-SR and SCDHEC onsite and offsite MEI dose[6]	**19.62**			
The combined estimate for the offsite MEI sportsman.[7]	**7.98**			

Notes:

1 – The nonsportsman public who is only exposed to the milk, air, edible vegetation, and the highest public water supply dose.

2 – The farmer scenario adds the sediments, soil, and highest well water dose in place of the public water supply dose to the public dose. The farmer is treated as a nonsportsman.

3 – The average sportsman is exposed to only the average game (deer, hog, fish) dose and uses the highest public, private, or river water source dose.

4 – Naturally occurring radioactive material (NORM) was excluded from the scenario averages.

5 – The maximally exposed individual (MEI) who hunts on SRS.

6 - The difference in DOE-SR dose > SCDHEC comparable media plus DOE-SR media not sampled by SCDHEC.

7- The highest offsite MEI dose excluding NORM includes all maximums and was 5.68 mrem for SCDHEC detections. The combined estimate adds the DOE-SR offsite hog estimate (2.30 mrem) not sampled by SCDHEC.

Table 6. 1999-2007 MEI Critical Pathways, Subpathways, and Potential Exposure Summary

Critical Pathways		Millirems	% of Total
Atmospheric Pathway (AP)		15.45	73.23
Liquid Pathway (LP)		5.65	26.77
Subpathways	Food or Ingestion Pathway (FP)	12.48	59.14
	Inhalation Pathway(IhP)	0.06	0.30
	Direct Exposure Pathway (DXP)	7.21	34.20
	Public Water Supply Pathway (PWSDW)	0.46	2.16
	Untreated Water Supply Pathway (NPDW)	0.88	4.19
Totals Check		21.09	100.00

Notes:

1 – AP is the atmospheric pathway dose.

2 – LP is the liquid pathway dose.

3 – FP is the food subpathway.

4 – IhP is the inhalation subpathway.

5 – DXP is the direct exposure subpathway

6 – PWSDW is the public water systems drinking water subpathway.

7 – NPDW is the nonpotable drinking water pathway.

Table 7. 2007 MEI All-Pathway and Sportsman Potential Dose Comparisons to DOE-SR

Pathway	Media	DOE-SR	SCDHEC	Add to SCDHEC
All-Pathway	Liquid plus Airborne	0.10	0.12	<
Sportsman	Onsite Hunter	9.00	**NS**	9.00
	Creek Mouth Fish	0.24	0.32	<
	Offsite Hog	2.30	**NS**	2.30
	Offsite Deer	1.90	2.66	<
	Hunter Soil Exposure	2.90	0.43	2.47
	Fisherman Soil Exposure	0.28	0.11	0.17
	Total Difference to be added for MEI			**13.94**
	SCDHEC MEI Sportsman	NA	**5.68**	NA
	SCDHEC plus DOE-SR MEI Additions	NA	**19.62**	NA

Notes: Comparisons from DOE-SR data Table 6-4 (WSRC 2007).

Table 8. Sportsman versus Nonsportsman Food

	2007		1999-07		
Food Categories	**Total mrem**	**Media**	**Avg.**	**SD**	**Median**
Sportsman Maximums	2.98	Fish,Deer,Hog	10.36	11.36	8.26
Nonsportsman Food (Average	0.14	Veg and Milk	0.08	0.08	0.05
All Food Total (average	12.47	All Food	**1.39**	**1.63**	**0.65**
Substitute Max Deer for Avg	3.67				
Substitute Max Fish for Avg	4.51				

Figure 1. Critical Pathways for Dose to the Public from the SRS

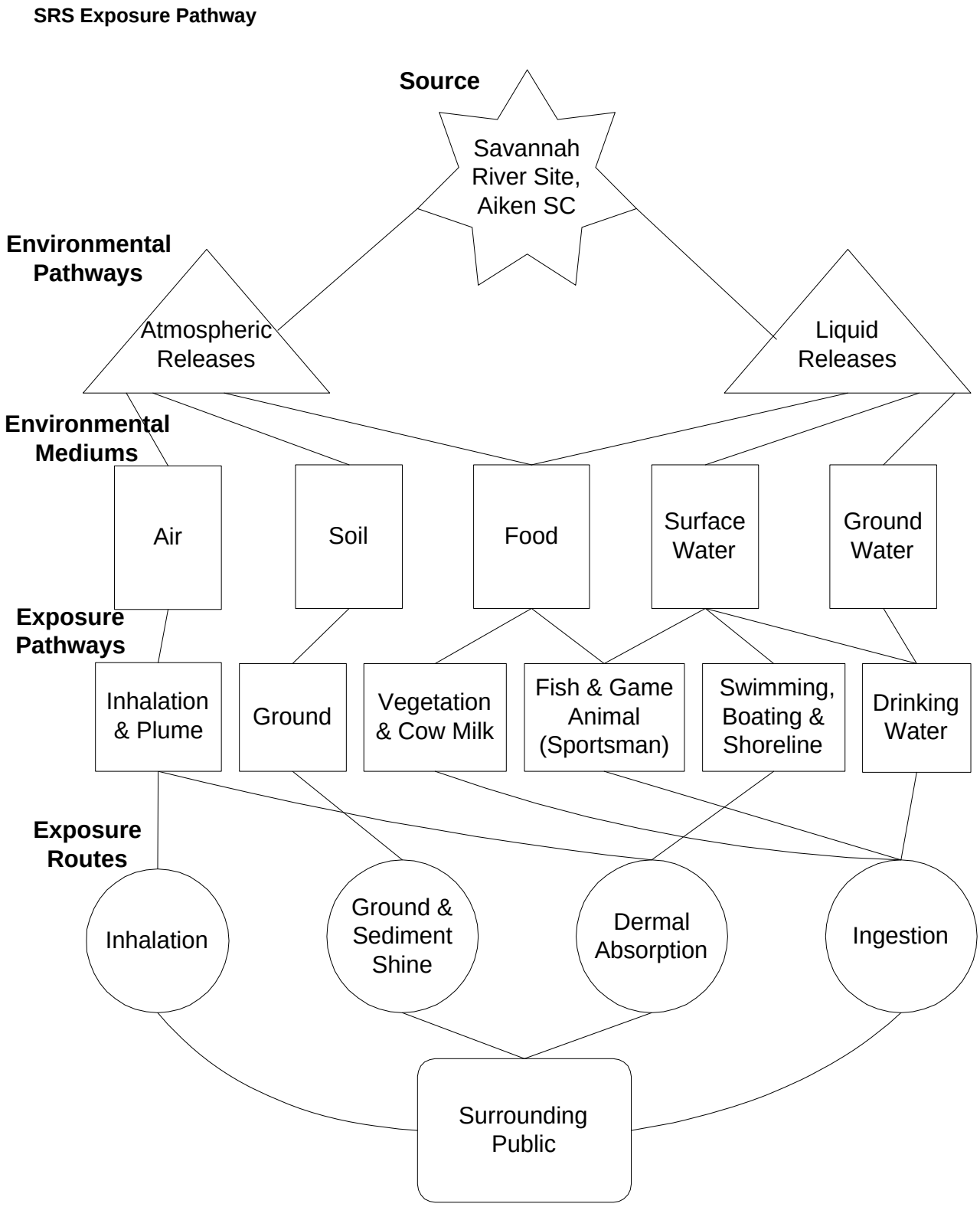
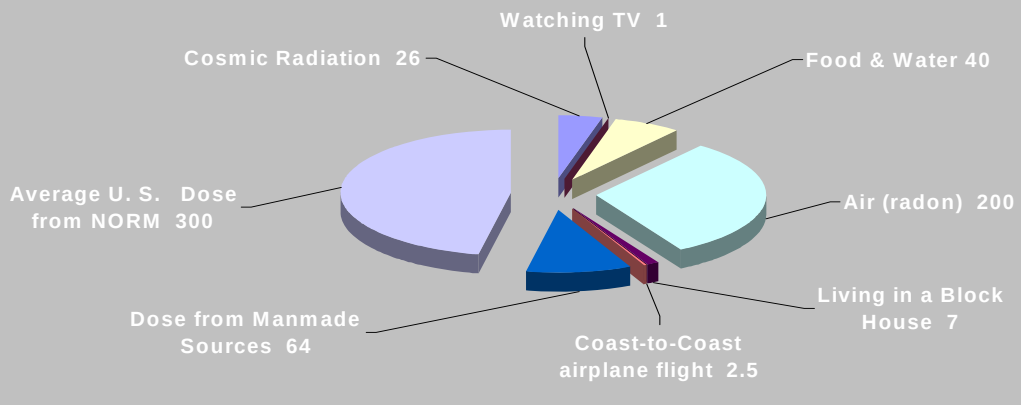
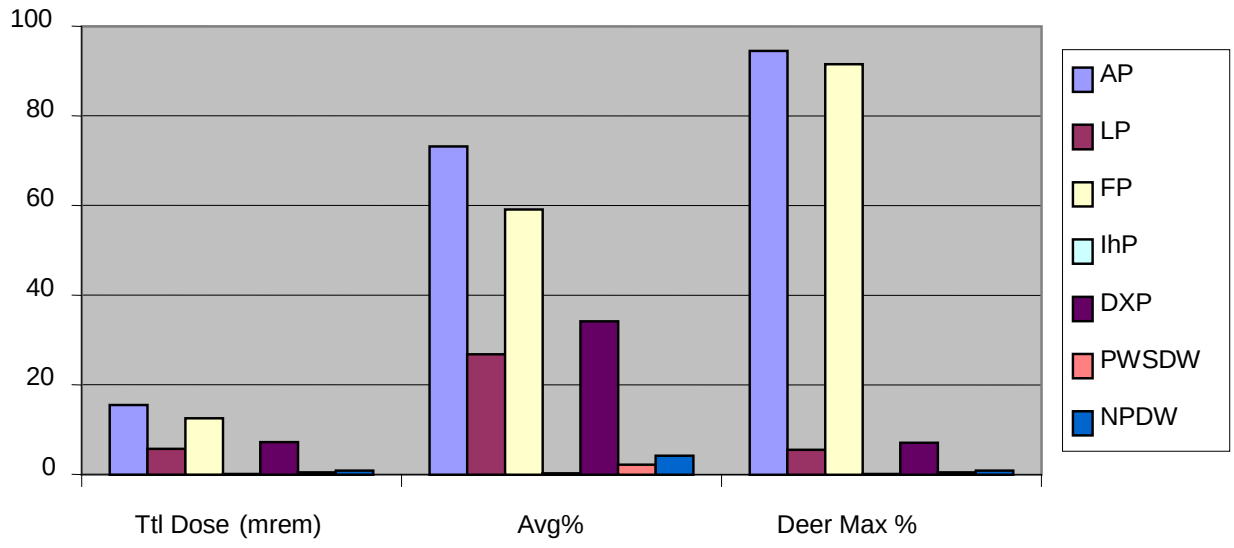


Figure 2. Comparison of Dose Levels (mrem/yr)



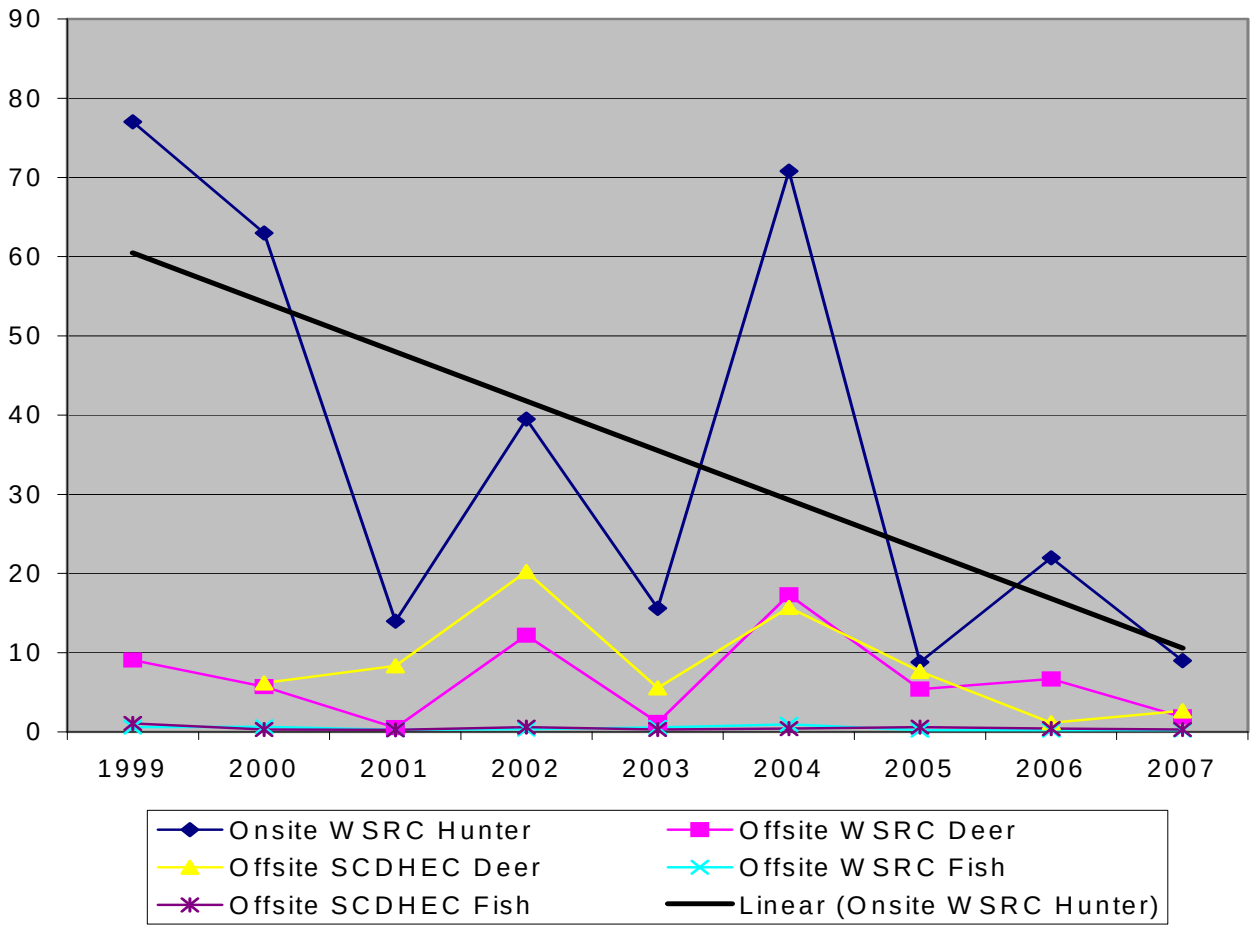
Notes:
1 – The average naturally occurring radioactive material (NORM) is 300 mrem/yr.
2 – Pie sections are relative to each other and not to percent of total.

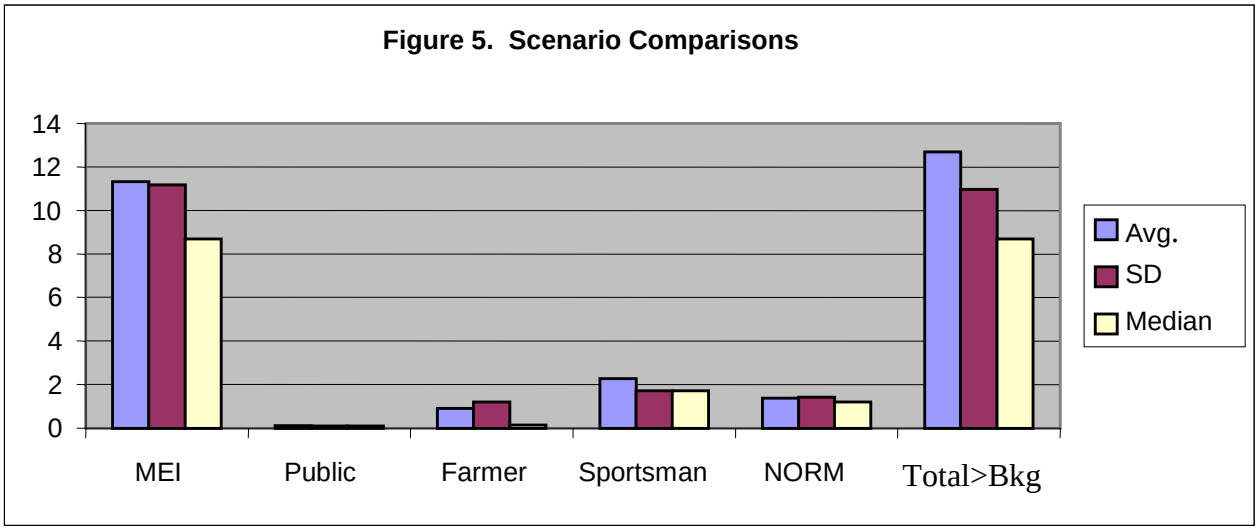
Figure 3. 1999-2007 Critical Pathway Basis Comparison



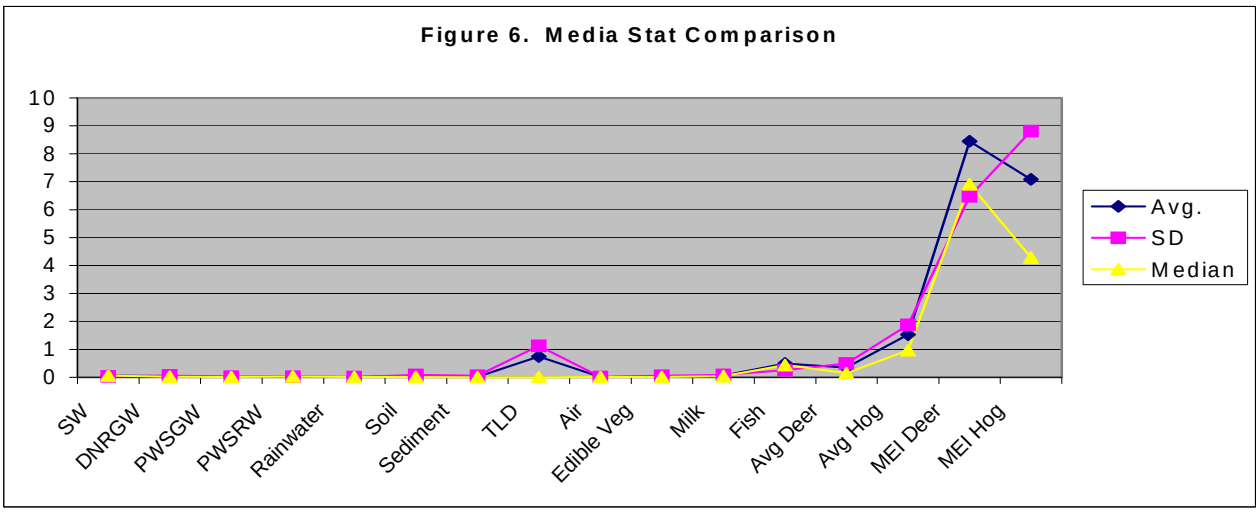
Notes:
1 – AP is the atmospheric pathway dose.
2 – LP is the liquid pathway dose.
3 – FP is the food pathway.
4 – IhP is the inhalation pathway.
5 – DXP is the direct exposure pathway
6 – PWSDW is the public water systems drinking water pathway.
7 – NPDW is the nonpotable drinking water pathway.
8 – Deer Max % shows how the % contributions change when the deer maximum dose is added.

Figure 4. SCDHEC and DOE-SR MEI Sportsman Dose (mrem) Comparison



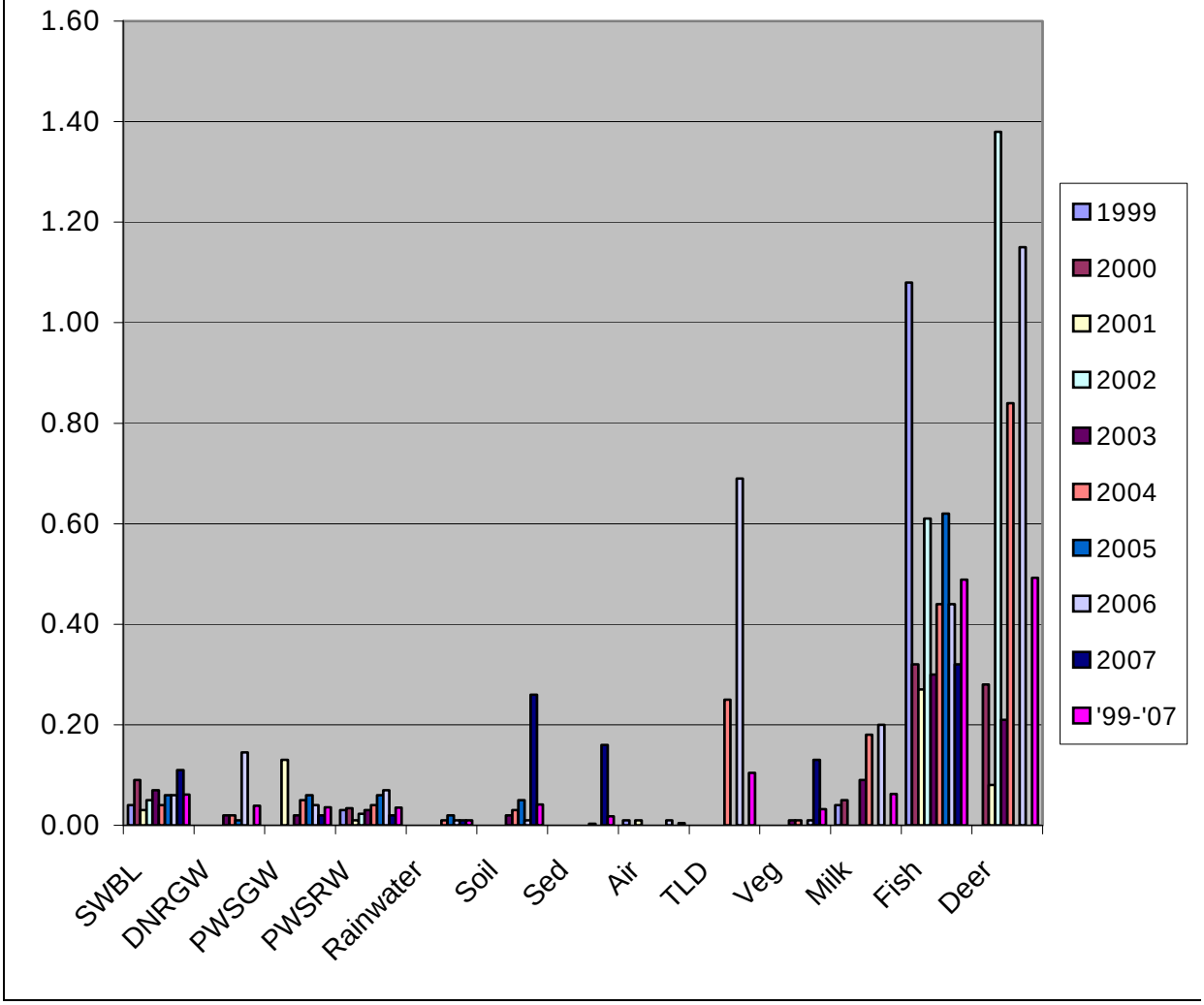


Notes: See the list of acronyms for abbreviation definitions.
1 – The MEI represented here is the sportsman deer maximum substituted for the average deer.

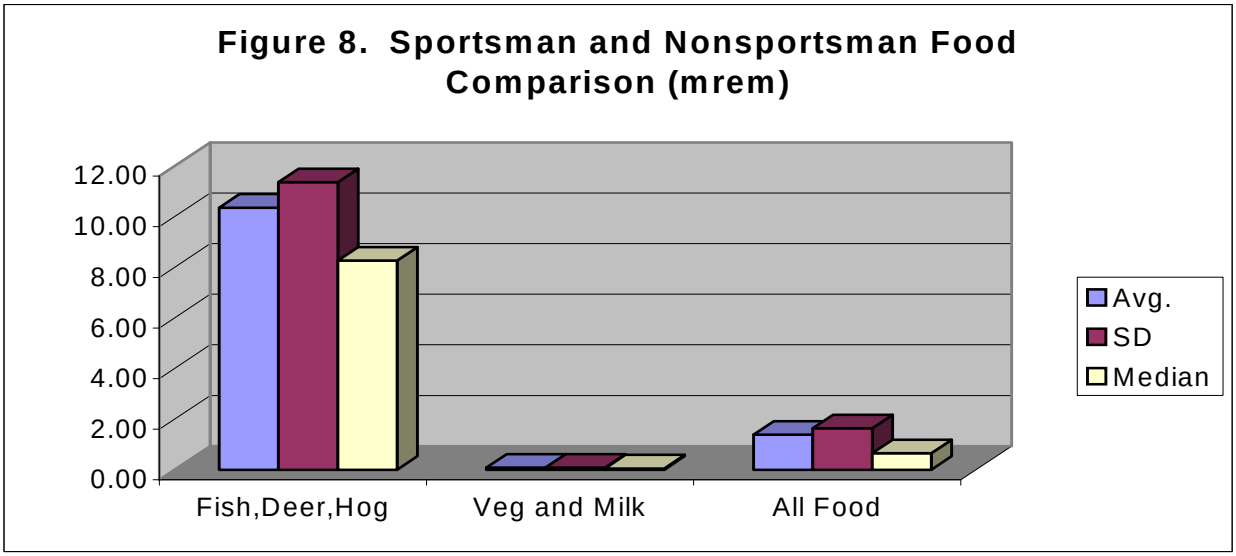


Notes:
1 – SW is surface water sources.
2 – DNRGW is the Department of Natural Resources groundwater wells.
3 – PWSGW is the public water supply groundwater wells.
4 - PWSRW is the public water supply riverwater sources.
5 – TLD is thermoluminescent dosimeters.
6 – Veg is vegetation.
7 – Avg is average.
8 – MEI Deer or Hog examples are the maximum exposure for the individual when the single highest maximum deer or hog hunter exposure was substituted for the average value.
9 – SD is standard deviation of the average.

Figure 7. SRS 50-Mile Perimeter Dose (mrem) Averages Excluding Probable NORM



Notes: These totals are from averages in media above South Carolina backgrounds.
1 – SWBL is the surface water at boat landings.
2 – DNRGW is the Department of Natural Resources groundwater wells.
3 – PWSGW is the public water supplies from groundwater.
4 – PWSRW is the public water supplies from riverwater.
5 – Sed is sediment and was replaced by riverbank soil at boat landings in 2007.
6 – TLD is thermoluminescent dosimeters.
7 – Veg is edible vegetation.



Notes:
1 – The extreme outliers for sportsman food dose (fish, deer, and hog maximums) are contrasted with the typical general public food dose averages (edible vegetation and milk) for 1999-2007.
2 – The "All Food" category shows the average dose from all food sources (sportsman and nonsportsman) on an average basis from 1999 through 2007.

Back to Tables and Figures

5.1.3 Data Tables

Critical Pathway Dose Report

2007 Average Dose Detections in Food Media 416

2007 Single Highest Dose Detections in Food Media 416

2007 Average Dose Detections in Water Media 417

2007 Single Highest Dose Detections in Water Media 418

2007 Average Dose Detections in Soil and Air Media 419

2007 Single Highest Dose Detections in Soil and Air Media 421

Notes:
1 – The following "Average Dose" data tables subtract an average background activity from the average activity of the listed radionuclide found in a media.
2 – The "Single Highest Dose" data tables subtract the average background from the single highest maximum for a particular radionuclide found in a media.
3 – The resultant net activity is multiplied by a consumption rate and dose factors from USEPA FGR and ICRP sources to obtain the dose result for a particular radionuclide and media source. The 2006 Dose Report and 2007 Critical Pathway Dose plan explain how these calculations result in a dose estimate in millirems per year.
4 – The last column gives the resultant dose that was assigned to the maximum exposed individual.
5 – The subtotal column exposure per radionuclide columns show other dose of interest; for example, NORM dose totals not assigned to the MEI.
6 – See the list of acronyms, radionuclides, and units for abbreviation definitions.
7 – Note that some tables are continued on a second page where the dose assigned to the MEI and NORM are totaled to represent typical dose from water (liquid pathway), soil and air (atmospheric pathway), and food (ingestion pathway) media.
8 - Section 4, Table 1 places the dose from media sources into applicable critical pathway categories. There are many crossover pathways; for example liquid dose can result in both direct exposure to the swimmer and water ingestion. Specific knowledge of the science, radionuclides, media, locations, and supporting media are required to properly assign dose as NORM or nonNORM.
9 – Examples of factors affecting dose assignment are discussed as needed.
10 – Calculations by SCDHEC are to three decimal places in millirem determinations and rounded as needed for appropriate comparisons to DOE-SR data.

Back to List of Data Tables

2007 Average Dose Detections in Food Media

Project	Isotope	Avg Activity	Bkg Activity	Net Activity	MCR	Dose mrem	Exposure per Radionuclide	Subtotals for Radiation Dose	MEI Dose
		Food Sources					Average Dose	Totals mrem/species	
Fish Ingestion		pCi/g	pCi/g	pCi/g	kg/yr	mrem	Fish mrem avg/rad	Bass	
Bass	H-3	8.11E-01	0.00E+00	0.811	48.2	0.003	H-3 avg dose	0.313	
	Cs-137	1.29E-01	0.00E+00	0.129	48.2	0.311	0.002	Catfish	
	Sr-89/90	nonedible portion		0.000	48.2	NA	Cs-137 avg dose	0.234	
				Bass	Avg	0.157	0.234	Pickerel	
Catfish	H-3	7.34E-01	0.00E+00	0.734	48.2	0.002	Sr-89/90 avg dose	0.169	
	Cs-137	9.60E-02	0.00E+00	0.096	48.2	0.231	0.043		
	Sr-89/90	nonedible portion		0.000	48.2	NA	All Fish Avg Dose	All Fish Total Dose	
				Catfish	Avg	0.117	0.119	0.716	
Pickerel	H-3	Not analyzed for tritium.							
	Cs-137	6.60E-02	0.00E+00	0.066	48.2	0.159	Highest Rads Ttl…….		
	Sr-89/90	1.80E-02	0.00E+00	0.018	48.2	0.010	0.324		
				Pickerel	Avg	0.085	MEI Highest Dose/Rad Ttls----------		0.324
Milk Ingestion		pCi/g	pCi/g	pCi/g	kg/yr	mrem	Milk mrem avg/rad	Milk Maximum Dose---	
Cow	H-3	<MDA	0.00E+00	0	230	0.000	H-3		
	Sr-89/90	2.27E-03	9.34E-04	0.001	230	0.004	0.000		
	Sr-89/90	Calculated as Sr-90					Sr-89/90	Cow Milk total dose	
Only detected rads are used in averages.			Co-60, I-131, Cs-137 were all <MDA.				0.004	0.004	
				Milk	Avg	0.002			
					Sum	0.004			
Subtracted an average of 3 background locations (Mk15,30,99).							MEI Milk Radioisope Dose----------		0.004
		Average Radionuclide Dose							
		Average		Average Bkg					
Game Animal		Dose/Animal		Dose/Animal			No hog samples.		
Ingestion		mrem		mrem		mrem	Deer Avg Dose		
Average Deer	Cs-137	6.00E-01		0.790		0.000	0		
	Maximally Exposed Individual Hunter						MEI Deer Dose		2.660
MEI Deer	Cs-137	3.45E+00		0.79		2.66	2.66		
		pCi/g	pCi/g	pCi/g	kg/yr	mrem			
Edible Veg (leafy)	H-3	2.28E-01	0.00E+00	0.228	73	0.001	Veg Avg Dose	Edible Veg Total Dose--	0.132
	Sr-89/90	7.60E-02	1.50E+00	0.000	73	0.000	0.033		
Edible Veg (fruits)	H-3	3.00E-01	3.01E-01	0.000	276	0.000			
	Sr-89/90	5.05E-02	1.10E-02	0.040	276	0.130		Total MEI Food Dose	3.119

2007 Single Highest Dose Detections in Food Media

Project	Isotope	Avg Activity	Bkg Activity	Net Activity	MCR	Dose mrem	Exposure per Radionuclide	Subtotals for Radiation Dose	MEI Dose
		Food Sources					Average Dose	Totals mrem/species	
Fish Ingestion		pCi/g	pCi/g	pCi/g	kg/yr	mrem	Fish mrem avg/rad	Bass	
Bass	H-3	2.93E+00	0.00E+00	3	48.2	0.009	H-3 avg dose	1.149	
	Cs-137	4.73E-01	0.00E+00	0.473	48.2	1.140	0.008	Catfish	
	Sr-89/90	1.73E-01	1.22E-01	0.000	48.2	0.000	Cs-137 avg dose	0.830	
				Bass	Avg	0.383	0.737	Pickerel	
Catfish	H-3	2.01E+00	0.00E+00	2.010	48.2	0.006	Sr-89/90 avg dose	0.263	
	Cs-137	3.42E-01	0.00E+00	0.342	48.2	0.824	0.006		
	Sr-89/90	1.09E-01	0.00E+00	0.000	48.2	0.000	All Fish Avg Dose	All Fish Total Dose	
				Catfish	Avg	0.277	0.264	2.243	
Pickerel	H-3	Not analyzed for tritium.							
	Cs-137	1.02E-01	0.00E+00	0.102	48.2	0.246	Highest Rads Ttl…….		
	Sr-89/90	3.00E-02	0.00E+00	0.030	48.2	0.017	1.166		
				Pickerel	Avg	0.132	MEI Highest Dose/Rad Ttl----------		1.166
Milk Ingestion		pCi/g	pCi/g	pCi/g	kg/yr	mrem	Milk mrem avg/rad	Milk Maximum Dose---	
Cow	H-3	<MDA	0.00E+00	0	230	0.000	H-3		
	Sr-89/90	6.44E-03	9.34E-04	0.006	230	0.015	0.000		
	Sr-89/90	Calculated as Sr-90					Sr-89/90	Cow Milk total dose	
Only detected rads are used in averages.			Co-60, I-131, Cs-137 were all <MDA.				0.015	0.015	
				Cow Milk	Avg	0.008			
					Sum	0.015			
Subtracted an average of 3 background locations (Mk15,30,99).							MEI Milk Radioisope Dose----------		0.015
		Average Radionuclide Dose							
		Average		Average Bkg					
Game Animal		Dose/Animal		Dose/Animal			No hog samples.		
Ingestion		mrem		mrem		mrem	Deer Avg Dose		
Average Deer	Cs-137	6.00E-01		0.790		0.000	0		
	Maximally Exposed Individual Hunter						MEI Deer Dose		2.660
MEI Deer	Cs-137	3.45E+00		0.79		2.66	2.66		
		pCi/g	pCi/g	pCi/g	kg/yr	mrem			
Edible Veg (leaves)	H-3	2.40E-01	0.00E+00	0.240	73	0.001	Veg Avg Dose	Edible Veg Total Dose--	0.132
	Sr-89/90	7.64E-02	1.50E+00	0.000	73	0.000	0.033		
Edible Veg (fruits)	H-3	4.10E-01	3.01E-01	0.000	276	0.000			
	Sr-89/90	5.05E-02	1.10E-02	0.040	276	0.130		Total MEI Food Dose	3.973

2007 Average Dose Detections in Water Media

Project	Isotope	Avg Activity	Bkg Activity	Net Activity	MCR	Dose mrem	Exposure per Radionuclide and Average Dose	NORM + nonNORM Subtotals for Radiation Dose	MEI Dose (mrem)
Water Sources									
PWSRW(DW) Ingestion		**pCi/L**	**pCi/L**	**pCi/L**	**L/yr**	**mrem**	**PWS mrem avg/rad**	**DWRW nonNORM ttl dose**	
Potable	**H-3**	**4.08E+02**	**2.68E+02**	140.000	730	**0.007**	Tritium	0.020	
Processed	**Unk Alpha**	**2.38E+00**	**4.07E+00**	0.000	730	0.000	Unk Alpha		
Water	**Unk Beta**	**5.05E+00**	**3.56E+00**	1.490	730	**0.013**	Unk Beta		
PWS River Water Radionuclide Average Dose					Avg	0.007	**Ttl PWSRW 0.02**		
Includes SW from Chelsea, Beaufort Jasper, and City of Savannah minus North Augusta background.									
PWSGW(DW) Ingestion		**pCi/L**	**pCi/L**	**pCi/L**	**L/yr**	**mrem**	**PWS mrem avg/rad**	**DWRW nonNORM ttl dose**	
Potable	**H-3**	**2.27E+02**	4.00E+00	223.000	730	**0.010**	Tritium	0.010	
Processed	**Unk Alpha**	**2.93E+00**	**8.40E+00**	0.000	730	0.000	Unk Alpha		
Water	**Unk Beta**	**<MDA**	**3.37E+00**	0.000	730	0.000	Unk Beta	**DWGW NORM total dose**	
	Pb-214	**1.29E+01**	**0.00E+00**	12.850	730	**0.006**	Pb-214	0.006	
Uses backgrounds from DNRGW.					NORM ttl	0.006	Natural tritium (prenuclear era) background is 4 pCi/L.		
PWS Ground Water Systems Radionuclide Average Dose					Avg	0.004	**Ttl PWSGW**		
DNRGW Ingestion		**pCi/L**	**pCi/L**	**pCi/L**	**L/yr**	**mrem**	**GW mrem avg/rad**	**DWRW nonNORM ttl dose**	
Possible Dose	**Pb-214**	**8.93E+00**	**0.00E+00**	8.930	730	**0.004**	Tritium		
at Private Wells	**Ra-226**	**4.88E-01**	**0.00E+00**	0.488	730	**0.472**	Radium-226		
in GW area.	e and fugitive releases.								
DNRGW from GW minus DNRGW backgrounds from GW project wells .									
	DNR Ground Water Average Dose				Avg	0.238	Total Private Well 0.00	**DNR NORM total**	
Total Private Well					Total	0.476		0.476	
Potable Water (PWS) Dose Average						0.044			
Nonpotable Ingestion		**pCi/L**	**pCi/L**	**pCi/L**	**L/yr**	**mrem**		**Total Boat Landing 0.114**	
SR Boat	**H-3**	**4.43E+02**	**2.68E+02**	175.000	730	**0.008**		**Sportsman Dose 0.119**	
Landings	**Unk Alpha**	**6.65E+00**	**4.07E+00**	2.580	730	**0.098**	Unk Alpha	**Nonpotable avg 0.032**	
RSW	**Unk Beta**	**4.45E+00**	**3.56E+00**	0.890	730	**0.008**	Unk Beta	**Cistern dose 0.014**	
Rainwater	**H-3**	**2.98E+02**	**0.00E+00**	298	730	**0.014**	**MEI Drinking Water Dose is from Survivalist, 0.114**		**0.114**
Cannot total doses from more than one DW source unless consumption rate of each is modified.									
Surface Water Averages (nonrandom boat landing and random detections)									
Surface Water		**pCi/L**	**pCi/L**	**pCi/L**	**hrs/yr**	**mrem**	**SRS Creek Mouth**	**Swimming Ingestion**	
Ingestion	**H-3**	**3.99E+02**	**2.46E+02**	**1.53E+02**	91	0.000	**Maximum Detect**	**0.001**	**0.001**
while swimming	**Alpha**	**5.14E+00**	**4.05E+00**	**1.09E+00**	91	**0.001**			
Surface Water		**pCi/L**	**pCi/L**	**pCi/L**	**hrs/yr**	**mrem**	**SRS Creek Mouth**	**Swimming Immersion**	
Immersion	**H-3**	**3.99E+02**	**2.46E+02**	**1.53E+02**	91	0.000	**No H-3 exposure DF**	0.000	
Exposure	**Alpha**	**5.14E+00**	**4.05E+00**	**1.09E+00**	91	0.000			
Surface Water		**pCi/L**	**pCi/L**	**pCi/L**	**hrs/yr**	**mrem**	**SRS Creek Mouth**	**Houseboat Exposure**	
Boating	**H-3**	**3.99E+02**	**2.46E+02**	**1.53E+02**	192	0.000	**No H-3 exposure DF**	0.000	
Exposure	**Alpha**	**5.14E+00**	**4.05E+00**	**1.09E+00**	192	0.000			
Surface Water		**pCi/L**	**pCi/L**	**pCi/L**	**hrs/yr**	**mrem**	**SRS Creek Mouth**	**Swamp House Exposure**	
Swamp Dweller	**H-3**	**3.99E+02**	**2.46E+02**	**1.53E+02**	4380	0.000	**No H-3 exposure DF**	0.000	
Exposure	**Alpha**	**5.14E+00**	**4.05E+00**	0.00E+00	4380	0.000			
Sediment Random plus Nonrandom Creek Mouth									
Sediment Dose Maximum		**pCi/g**	**pCi/g**	**pCi/g**	**hrs/yr**	**mrem**	**Skin contact**	**Wading Barefoot**	**0.059**
Direct	**Ra-226**	**2.12E+00**	**2.14E+00**	-1.89E-02	91	0.000	Ra-226	0.466	
	Pb-212	**1.30E+00**	**7.31E-01**	0.571	91	**0.073**	Pb-212		
Exposure	**Pb-214**	**9.79E-01**	**6.96E-01**	2.84E-01	91	**0.175**	Pb-214		
	Ac-228	**1.15E+00**	**1.11E+00**	0.035	91	**0.113**	Ac-228		
	Mn-54	**4.84E-02**	**0.00E+00**	0.048	91	0.000	Mn-54		
	Th-234	**3.86E+00**	**0.00E+00**	3.86E+00	91	**0.045**	Th-234		
	Cs-137	**4.75E-01**	**2.77E-01**	1.98E-01	91	**0.009**	Cs-137	**DNR NORM total**	
	Tc-99	**3.78E-01**	**0.00E+00**	0.378	91	0.000	Tc-99	0.407	
	Eu-155	**5.14E-01**	**1.67E-01**	0.347	91	0.000	Eu-155	**MEI DW Highest Dose**	**0.174**
	as Pu-239	**2.00E+01**	**0.00E+00**	20.000	91	**0.050**	Unk Alpha	**Add NORM dose**	**0.889**
	as Sr-90	**1.91E+01**	**0.00E+00**	19.089	91	0.000	Unk Beta	**Total Dose**	**1.063**

2007 Single Highest Dose Detections in Water Media

Project	Isotope	Avg Activity	Bkg Activity	Net Activity	MCR	Dose mrem	Exposure per Radionuclide and Average Dose	NORM + nonNORM Subtotals for Radiation Dose	MEI Dose (mrem)
Water Sources									
PWSRW(DW) Ingestion		**pCi/L**	**pCi/L**	**pCi/L**	**L/yr**	**mrem**	**PWSRW max mrem**	**DWRW nonNORM total dose**	
Potable	**H-3**	**7.06E+02**	**2.68E+02**	438.000	730	**0.020**	Gamma 0.00	0.056	
Processed	**Unk Alpha**	**2.38E+00**	**4.07E+00**	0.000	730	0.000	Alpha 0.00		
Water	**Unk Beta**	**7.66E+00**	**3.56E+00**	4.100	730	**0.036**	Beta 0.028		
Includes SW from Chelsea, Beaufort Jasper, and City of Savannah minus North Augusta background.									
PWS River Water Radionuclide Average Dose					Avg	0.010	**Ttl PWSRW 0.02**		
PWSGW(DW) Ingestion		**pCi/L**	**pCi/L**	**pCi/L**	**L/yr**	**mrem**	**PWS max mrem**	**DWGW nonNORM total dose**	
Potable	**H-3**	**3.02E+02**	4.00E+00	298.000	730	**0.014**	Gamma 0.01	0.014	
Processed	**Unk Alpha**	**4.32E+00**	**8.40E+00**	0.000	730	0.000	Alpha 0.00		
Water	**Unk Beta**	**<MDA**	**3.37E+00**	0.000	730	0.000	Beta 0.01	**DWGW NORM total dose**	
	Pb-214	**1.29E+01**	**0.00E+00**	12.850	730	**0.006**		0.006	
Uses backgrounds from DNRGW.					NORM ttl	0.006	Natural tritium (prenuclear era) background is 4 pCi/L.		
PWS Ground Water Systems Radionuclide Average Dose					Avg	0.000	**Ttl PWSGW 0.00**		
DNRGW Ingestion		**pCi/L**	**pCi/L**	**pCi/L**	**L/yr**	**mrem**	**GW mrem avg/rad**	**DWGW nonNORM total dose**	
Possible Dose	**H-3**	**<MDA**	4.00E+00	0.000	730	0.000	Gamma 0.25	0.000	
at Private Wells	**Unk Alpha**	**3.57E+00**	**8.40E+00**	0.000	730	0.000	Alpha 0.00		
in GW area.	**Unk Beta**	**8.95E+00**	**3.37E+00**	0.000	730	0.000	Beta 0.00		
Th-232 series	**Pb-214**	**8.93E+00**	**0.00E+00**	8.930	730	**0.004**	Diffuse and fugitive releases.		
	Ra-226	**5.09E-01**	**0.00E+00**	0.509	730	**0.493**			
DNRGW from GW minus DNRGW backgrounds from GW project wells .									
	DNR Ground Water Average Dose				Avg	0.000	Total Private Well 0.00	**DNR NORM total**	
Total Private Well					Total	0.000		0.497	
Potable Water (PWS) Dose Average						0.007			
Nonpotable Ingestion		**pCi/L**	**pCi/L**	**pCi/L**	**L/yr**	**mrem**	**Total Boat Landing 0.114**		
SR Boat	**H-3**	**4.08E+03**	**2.68E+02**	3814.000	730	**0.178**	**Sportsman Dose 0.119**	**Survivalist exposed to**	
Landings	**Unk Alpha**	**1.05E+01**	**4.07E+00**	6.430	730	**0.243**	**Nonpotable avg 0.032**	**single maximum**	
RSW	**Unk Beta**	**6.22E+00**	**3.56E+00**	2.660	730	**0.023**	**Cistern dose 0.013**		
Rainwater	**H-3**	**4.71E+02**	**0.00E+00**	471	730	**0.022**	**MEI Drinking Water Dose is from Survivalist.**		**0.445**
Cannot total doses from more than one DW source unless consumption rate of each is modified.									
Surface Water MEI from Creek Mouth Detections									
Surface Water		**pCi/L**	**pCi/L**	**pCi/L**	**hrs/yr**	**mrem**	**SRS Creek Mouth**	**Swimming Ingestion**	
Ingestion	**H-3**	**5.38E+04**	4.00E+00	**5.38E+04**	91	**0.031**	**Maximum Detect**	**0.031**	**0.031**
while swimming	**Alpha**	**2.35E+01**	**4.07E+00**	0.00E+00	91	0.000			
	Beta	**2.49E+01**	**3.56E+00**	0.00E+00	91	0.000			
Surface Water		**pCi/L**	**pCi/L**	**pCi/L**	**hrs/yr**	**mrem**	**SRS Creek Mouth**	**Swimming Immersion**	
Immersion	**H-3**	**5.38E+04**	4.00E+00	**5.38E+04**	91	0.000	**No H-3 exposure DF**	0.000	
Exposure	**Alpha**	**2.35E+01**	**4.07E+00**	0.00E+00	91	0.000			
	Beta	**2.49E+01**	**3.56E+00**	0.00E+00	91	0.000			
Surface Water		**pCi/L**	**pCi/L**	**pCi/L**	**hrs/yr**	**mrem**	**SRS Creek Mouth**	**Houseboat Exposure**	
Boating	**H-3**	**5.38E+04**	4.00E+00	**5.38E+04**	192	0.000	**No H-3 exposure DF**	0.000	
Exposure	**Alpha**	**2.35E+01**	**4.07E+00**	0.00E+00	192	0.000			
	Beta	**2.49E+01**	**3.56E+00**	0.00E+00	192	0.000			
Surface Water		**pCi/L**	**pCi/L**	**pCi/L**	**hrs/yr**	**mrem**	**SRS Creek Mouth**	**Swamp House Exposure**	
Swamp Dweller	**H-3**	**5.38E+04**	4.00E+00	**5.38E+04**	4380	0.000	**No H-3 exposure DF**	0.000	
Exposure	**Alpha**	**2.35E+01**	**4.07E+00**	0.00E+00	4380	0.000			
	Beta	**2.49E+01**	**3.56E+00**	0.00E+00	4380	0.000			
Sediment Dose		**pCi/g**	**pCi/g**	**pCi/g**	**hrs/yr**	**mrem**	**Skin contact**	**Wading Barefoot**	**0.059**
Direct	**Ra-226**	**5.10E+00**	**2.14E+00**	2.96E+00	91	**0.016**	Ra-226	0.482	
Exposure	**Pb-212**	**3.39E+00**	**7.31E-01**	0.571	91	**0.073**	Pb-212		
Used maximum sedi	**Pb-214**	**1.75E+00**	**6.96E-01**	2.84E-01	91	**0.175**	Pb-214		
	Ac-228	**3.60E+00**	**1.11E+00**	0.035	91	**0.113**	Ac-228		
	Mn-54	**7.70E-02**	**0.00E+00**	0.048	91	0.000	Mn-54		
	Th-234	**4.02E+00**	**0.00E+00**	3.86E+00	91	**0.045**	Th-234		
	Cs-137	**2.27E+00**	**2.77E-01**	1.98E-01	91	**0.009**	Cs-137	**DNR NORM total**	
	Tc-99	**4.32E-01**	**0.00E+00**	0.378	91	0.000	Tc-99	0.423	
	Eu-155	**8.49E-01**	**1.67E-01**	0.347	91	0.000	Eu-155	**MEI DW Highest Dose**	**0.535**
as Pu-239	**Alpha**	**2.35E+01**	**0.00E+00**	20.000	91	**0.050**	Alpha	**Add NORM dose**	**0.926**
as Sr-90	**Beta**	**2.49E+01**	**0.00E+00**	19.089	91	0.000	Beta	**Total Dose**	**1.461**

2007 Average Dose Detections in Soil and Air

Project	Isotope	Avg	Bkg	Net	MCR	Dose	Exposure	NORM	MEI
		Activity	Activity	Activity		mrem	per Radionuclide	Subtotals for	Dose
Surface Soil & Riverbank Soil Depositions Primarily from Atmospheric Pathways								Radiation Dose	Total
Surface Soil & Riverbank Soil Random and Nonrandom Sample Detections									
Surface Soil Ingestion		pCi/g	pCi/g	pCi/g	mg/day	mrem	Total nonNORM Soil Ingestion Dose>Bkg is		0.024
Th-232 series	Pb-212	1.24E+00	9.94E-01	0.249	100	0.000	Gamma Avg	0.008	
U-238 series	Pb-214	1.36E+00	9.35E-01	0.423	100	0.000	Alpha Avg	0.011	
	Ra-226	3.01E+00	2.20E+00	0.810	100	0.039	Beta Avg 0.001	0.001	
	Ac-228	1.21E+00	1.07E+00	0.143	100	0.000	Gamma Total	0.053	
	Th-234	5.34E+00	3.20E+00	2.146	100	0.001	Alpha Total	0.011	
Farming potential dose for upturned NORM.				Avg	0.008		Beta Total	0.001	
Pu-241 series	Am-241	5.15E-01	4.35E-01	0.080	100	0.011	Total NORM	0.041	
	Cs-137	1.19E+00	2.93E-01	0.896	100	0.002	NORM avg	0.008	
Unknown Alpha	as Pu-239	2.87E+01	2.30E+01	5.667	100	0.011	nonNORM avg	0.006	
Unknown Beta	as Sr-90	1.94E+01	1.66E+01	2.770	100	0.001		Ttl NORM dose	
Potential nonNORM dose average.					0.006	0.024	Ttl potential nonNORM	0.041	
Riverbank Soil Ingestion		pCi/g	pCi/g	pCi/g	mg/day	mrem	Total nonNORM Soil Ingestion Dose>Bkg is		0.001
Th-232 series	Pb-212	1.33E+00	9.94E-01	0.338	100	0.001	Gamma Avg	0.001	
	Cs-137	6.33E-01	1.95E-01	0.438	100	0.001	Gamma Total	0.001	
Sportsman potential riverbank soil ingestion dose at public boat landings.							NORM avg	Ttl NORM dose	
Potential nonNORM dose average.					0.001		0.001	0.001	
All Soil Ingestion Average Dose (NORM plus nonNORM)					Avg	0.001			
Surface Soil Direct Exposure		pCi/g	pCi/g	pCi/g	hrs/yr	mrem	Total nonNORM Direct Dose>Bkg is		0.236
Th-232 series	Pb-212	1.24E+00	9.94E-01	0.249	4380	0.034	Gamma Avg	0.028	
U-238 series	Pb-214	1.36E+00	9.35E-01	0.423	4380	0.108	Alpha Avg	0.003	
	Ra-226	3.01E+00	2.20E+00	0.810	4380	0.005	Beta Avg	0.230	
	Ac-228	1.21E+00	1.07E+00	0.143	4380	0.038	Gamma Total	0.199	
	Th-234	5.34E+00	3.20E+00	2.146	4380	0.011	Alpha Total	0.003	
Farming potential dose for direct soil exposure.				Avg			Beta Total	0.230	
Pu-241 series	Am-241	5.15E-01	4.35E-01	0.080	4380	0.001	Total NORM	0.196	
	Cs-137	1.19E+00	2.93E-01	0.896	4380	0.0027	NORM Avg	0.039	
Unknown Alpha	as Pu-239	2.87E+01	2.30E+01	5.667	4380	0.0028	nonNORM Avg	0.059	
Unknown Beta	as Sr-90	1.94E+01	1.66E+01	2.770	4380	0.230		Ttl NORM dose	
Potential nonNORM dose average.					0.059			0.196	
Surface Soil Direct Exposure Average Dose					0.048		ambient beta-gamma direct dose		0.000
			Beaufort Bkg				98-mrem control		
TLD[1]	beta-gamma	9.65E+01	9.90E+01	0.000	mrem	0.000	Building (beta-gamma) 98-mrem control		
No reduction factors or source assumptions assigned for unknown beta-gamma.						50-mile perimeter detection average < Beaufort background.			
See note*	Direct Ground Shine Exposure Avg Dose				Avg	0.043			
Riverbank Soil Direct Exposure		pCi/g	pCi/g	pCi/g	hrs/yr	mrem	Riverbank Soil Total nonNORM Direct Exposure		0.112
Th-232 series	Pb-212	1.33E+00	9.94E-01	0.338	4380	0.046	Gamma Avg	0.079	
	Cs-137	6.33E-01	1.95E-01	0.438	4380	0.112	Gamma Total	0.158	
Potential nonNORM dose average.							NORM avg	Ttl NORM dose	
Sportsman potential riverbank soil direct dose at public boat landings.							0.046	0.046	

2007 Average Dose Detections in Soil and Air - continued									
Soil Resuspension and Inhalation Dose									
Surface Soil Resuspension		**pCi/g**	**pCi/g**	**pCi/g**	**m3/yr**	**mrem**	**nonNORM Potential from Farmland Soils**		**NA**
Th-232 series	**Pb-212**	**1.24E+00**	**9.94E-01**	**0.249**	8000	0.000	**Gamma Avg**	0.005	
U-238 series	**Pb-214**	**1.36E+00**	**9.35E-01**	**0.423**	8000	0.000	**Alpha Avg**	0.000	
	Ra-226	**3.01E+00**	**2.20E+00**	**0.810**	8000	**0.006**	**Beta Avg**	1.399	
	Ac-228	**1.21E+00**	**1.07E+00**	**0.143**	8000	0.000	**Gamma Total**	0.034	
	Th-234	**5.34E+00**	**3.20E+00**	**2.146**	8000	0.000	**Alpha Total**	0.000	
					8000	0.000	**Beta Total**	1.399	
Ttl nonNORM resuspension potential Inhalation Dose>Bkg is not				Avg			**Total NORM**	0.006	
	Am-241	**5.15E-01**	**4.35E-01**	**0.080**	8000	**0.028**	**NORM Avg**	0.001	
Pu-241 series	**Cs-137**	**1.19E+00**	**2.93E-01**	**0.896**	8000	0.000	**nonNORM Avg**	0.476	
Unk Alpha	**as Pu-239**	**2.87E+01**	**2.30E+01**	**5.667**	8000	**1.399**		**Ttl NORM dose**	
Unk Beta	**as Sr-90**	**1.94E+01**	**1.66E+01**	**2.770**	8000	**0.003**		1.436	
Potential nonNORM dose average.					0.358				
Surface Soil Resuspension Total Inhalation Avg Dose					1.436				
Resuspended nonNORM assigned as NORM since resuspension of soil at depth unlikely							Assigned as NORM since air filters did not confirm resuspension.		
except in farming, and air filters failed to confirm this resuspension (thus NA). Compare soil alpha to air alpha.									
Riverbank Soil Resuspension		**pCi/g**	**pCi/g**	**pCi/g**	**m3/yr**	**mrem**	**nonNORM Potential from Riverbank Soil**		**0.000**
Th-232 series	**Pb-212**	**1.33E+00**	**9.94E-01**	**0.338**	8000	0.000	**Gamma Avg**	0.000	
	Cs-137	**6.33E-01**	**1.95E-01**	**0.438**	8000	0.000	**Gamma Total**	0.000	
Sportsman or Recreational potential riverbank soil ingestion dose at **public boat landings**.							**NORM avg**	**Ttl NORM dose**	
							4.56676E-05	0.000	
Potential nonNORM dose average.					**0.000**		Air filter stations not located near boat docks.		
Riverbank Soil Resuspension Inhalation Average Dose					0.000	0.000	Total Riverbank Soil Resuspension Dose		
Air Inhalation		**pCi/m3**	**pCi/m3**	**pCi/m3**	**Avg**	**0.000**	**nonNORM potential from Air Inhalation**		**0.002**
Inhalation	**H-3**	**4.59E+00**	0.00E+00	**5**	8000	**0.002**			
	Alpha	**3.80E-03**	**4.20E-03**	**0.000**	8000	0.000	**based on Pu-239.**	**MEI nonNORM Dose**	**0.375**
	Beta	**2.41E-02**	**2.45E-02**	**0.000**	8000	0.000	**based on Sr-90.**	**NORM Total Dose**	**1.719**
Air Inhalation Average Dose/Detected Radionuclides				**0.001**	**Total Air**	**0.002**		**Total NORM and MEI**	**2.095**

2007 Single Highest Dose Detection Only For Soil and Air

Project	Isotope	Avg Activity	Bkg Activity	Net Activity	MCR	Dose mrem	Exposure per Radionuclide	NORM Subtotals for Radiation Dose	MEI Dose Total
Surface Soil & Riverbank Soil Depositions Primarily from Atmospheric Pathways									
Surface Soil & Riverbank Soil Random and Nonrandom Sample Detections									
Surface Soil Ingestion		pCi/g	pCi/g	pCi/g	mg/day	mrem	Total nonNORM Soil Ingestion Dose>Bkg is		0.109
Th-232 series	**Pb-212**	**2.20E+00**	**9.94E-01**	**1.203**	100	**0.002**	**Gamma Avg**	0.041	
U-238 series	**Pb-214**	**2.90E+00**	**9.35E-01**	**1.960**	100	0.000	**Alpha Avg**	0.031	
	Ra-226	**6.55E+00**	**2.20E+00**	**4.357**	100	**0.211**	**Beta Avg**	0.004	
	Ac-228	**2.19E+00**	**1.07E+00**	**1.122**	100	0.000	**Gamma Total**	0.288	
	Th-234	**6.86E+00**	**3.20E+00**	**3.663**	100	**0.002**	**Alpha Total**	0.031	
							Beta Total	0.004	
Pu-241 series	**Am-241**	**7.62E-01**	**4.35E-01**	**0.327**	100	**0.044**	**Total NORM**	0.215	
	Cs-137	**1.67E+01**	**2.93E-01**	**16.387**	100	**0.030**	**NORM avg**	0.043	
Unknown Alpha	**as Pu-239**	**3.92E+01**	**2.30E+01**	**16.200**	100	**0.031**	**nonNORM Avg**	0.027	
Unknown Beta	**as Sr-90**	**2.68E+01**	**1.66E+01**	**10.167**	100	**0.004**		**Ttl NORM dose**	
Farming potential dose for upturned NORM ingestion----------.					Avg	**0.036**	**0.109**		**0.215**
Riverbank Soil Ingestion		pCi/g	pCi/g	pCi/g	mg/day	mrem	Total nonNORM Soil Ingestion Dose>Bkg is		0.004
Th-232 series	**Pb-212**	**1.49E+00**	**0.00E+00**	**1.493**	100	**0.002**	**Gamma Avg**	0.001	
U-238 series	**Pb-214**	**1.455**	**1.27**	**0.185**	100	0.000	**Alpha Avg**	<	
	Ac-228	**1.40E+00**	**1.32E+00**	**0.082**	100	0.000	**Beta Avg 0.001**	0.001	
	Cs-137	**2.09E+00**	**3.42E-01**	**1.746**	100	**0.003**	**Gamma Total**	0.006	
Unknown Beta	**as Sr-90**	**1.82E+01**	**1.65E+01**	**1.700**	100	**0.001**	**Alpha Total**	<	
Sportsman or Recreational potential riverbank soil ingestion dose at **public boat landings**.							**Beta Total**	0.001	
Potential **nonNORM** dose **average**----------.						**0.002**	**NORM avg**	**Ttl NORM dose**	
All Soil Ingestion Average Dose (NORM plus nonNORM)					Avg	0.001	0.001	**0.002**	
Surface Soil Direct Exposure		pCi/g	pCi/g	pCi/g	hrs/yr	mrem	Total nonNORM Direct Dose>Bkg is		0.904
Th-232 series	**Pb-212**	**2.20E+00**	**9.94E-01**	**1.203**	4380	**0.163**	**Gamma Avg**	0.152	
U-238 series	**Pb-214**	**2.90E+00**	**9.35E-01**	**1.960**	4380	**0.501**	**Alpha Avg**	0.008	
	Ra-226	**6.55E+00**	**2.20E+00**	**4.357**	4380	**0.027**	**Beta Avg**	0.843	
	Ac-228	**2.19E+00**	**1.07E+00**	**1.122**	4380	**0.299**	**Gamma Total**	1.062	
	Th-234	**6.86E+00**	**3.20E+00**	**3.663**	4380	**0.018**	**Alpha Total**	0.008	
							Beta Total	0.843	
Pu-241 series	**Am-241**	**7.62E-01**	**4.35E-01**	**0.327**	4380	**0.003**	**Total NORM**	1.009	
	Cs-137	**1.67E+01**	**2.93E-01**	**16.387**	4380	**0.050**	**NORM Avg**	0.202	
Unknown Alpha	**as Pu-239**	**3.92E+01**	**2.30E+01**	**16.200**	4380	**0.008**	**nonNORM Avg**	0.226	
Unknown Beta	**as Sr-90**	**2.68E+01**	**1.66E+01**	**10.167**	4380	**0.843**		**Ttl NORM dose**	
Farming potential dose for direct soil exposure----------.					Avg	**0.213**		**1.009**	
Surface Soil Direct Exposure Average Dose					0.213		**ambient beta-gamma direct dose**		**7.000**
TLD[1]	**beta-gamma**	**1.06E+02**	**9.90E+01**	**7.000**	**mrem**	0.000	**lding (beta-gamma) 98-mrem control**		
No reduction factors or source assumptions assigned for unknown beta-gamma.						**50-mile perimeter detection average < Beaufort background.**			
See note*	**Direct Ground Shine Exposure Avg Dose**				**Avg**	0.191			
Riverbank Soil Direct Exposure		pCi/g	pCi/g	pCi/g	hrs/yr	mrem	Riverbank Soil Total nonNORM Direct Exposure		0.146
Th-232 series	**Pb-212**	**1.49E+00**	**0.00E+00**	**1.493**	4380	**0.203**	**Gamma Avg**	0.069	
U-238 series	**Pb-214**	**1.455**	**1.27**	**0.185**	4380	**0.047**	**Alpha Avg**	<	
	Ac-228	**1.40E+00**	**1.32E+00**	**0.082**	4380	**0.022**	**Beta Avg 0.001**	0.141	
	Cs-137	**2.09E+00**	**3.42E-01**	**1.746**	4380	**0.005**	**Gamma Total**	0.277	
Unknown Beta	**as Sr-90**	**1.82E+01**	**1.65E+01**	**1.700**	4380	**0.141**	**Alpha Total**	<	
Potential **nonNORM** dose **average**.						**0.000**	**Beta Total**	0.141	
Sportsman or Recreational potential riverbank soil direct dose at **public boat landings**.							**NORM avg**	**Ttl NORM dose**	
							0.091	**0.272**	
Riverbank Soil Direct Dose (NORM&nonNORM)					**Avg**	0.148			

2007 Single Highest Dose Detection Only For Soil and Air - continued

Soil Resuspension and Inhalation Dose									MREM
Surface Soil Resuspension		pCi/g	pCi/g	pCi/g	m3/yr	mrem	nonNORM Potential from Farmland Soils		NA
Th-232 series	Pb-212	2.20E+00	9.94E-01	1.203	8000	0.000	Gamma Avg	0.021	
U-238 series	Pb-214	2.90E+00	9.35E-01	1.960	8000	0.000	Alpha Avg	3.998	
	Ra-226	6.55E+00	2.20E+00	4.357	8000	0.030	Beta Avg	0.011	
	Ac-228	2.19E+00	1.07E+00	1.122	8000	0.000	Gamma Total	0.147	
	Th-234	6.86E+00	3.20E+00	3.663	8000	0.000	Alpha Total	3.998	
Ttl nonNORM resuspension potential Inhalation Dose>Bkg is not confirme				Avg			Beta Total	0.011	NA
	Am-241	7.62E-01	4.35E-01	0.327	8000	0.116	Total NORM	0.030	
Pu-241 series	Cs-137	1.67E+01	2.93E-01	16.387	8000	0.000	NORM Avg	0.006	
Unk Alpha	as Pu-239	3.92E+01	2.30E+01	16.200	8000	3.998	nonNORM Avg	1.031	
Unk Beta	as Sr-90	2.68E+01	1.66E+01	10.167	8000	0.011		Ttl NORM dose	
Potential nonNORM dose average.					1.031			4.156	
Surface Soil Resuspension Total Inhalation Average Dose					4.156		Soil Total Dose-1.488		
Resuspended nonNORM assigned as NORM since							Assigned as NORM since air filters did not confirm resuspension.		
resuspension of soil at depth unlikely except in farming, and air filters failed to confirm this resuspension. Compare soil alpha to air alpha.									
Riverbank Soil Resuspension		pCi/g	pCi/g	pCi/g	m3/yr	mrem	nonNORM Potential from Riverbank Soil		0.002
Th-232 series	Pb-212	1.49E+00	0.00E+00	1.493	8000	0.000	Gamma Avg	0.000	
U-238 series	Pb-214	1.455	1.27	0.185	8000	0.000	Alpha Avg	<	
	Ac-228	1.40E+00	1.32E+00	0.082	8000	0.000	Beta Avg 0.001	0.002	
	Cs-137	2.09E+00	3.42E-01	1.746	8000	0.000	Gamma Total	0.000	
Unknown Beta	as Sr-90	1.82E+01	1.65E+01	1.700	8000	0.002	Alpha Total	<	
Potential nonNORM dose average.					8000	0.000	Beta Total	0.002	
					8000	0.000	NORM avg	Ttl NORM dose	
					8000	0.000	0.000	0.000	
					8000	0.000			
Potential nonNORM dose average.					0.000		Air filter stations not located near boat docks.		
Riverbank Soil Resuspension Inhalation Average Dose					0.000	0.002	Total Riverbank Soil Resuspension Dose		
Air Inhalation		pCi/m3	pCi/m3	pCi/m3	Avg	0.000	nonNORM potential from Air Inhalation----------		0.004
Inhalation	H-3	8.08E+00	0.00E+00	8	8000	0.004			
	Alpha	6.90E-02	4.20E-03	0.000	8000	0.000	based on Pu-239.	MEI nonNORM Dose	8.169
	Beta	9.02E-02	2.45E-02	0.000	8000	0.000	based on Sr-90.	NORM Total Dose	5.654
Air Inhalation Average Dose/Detected Radionuclides				0.001	Total Air	0.004		Total NORM and MEI	13.823

Back to List of Data Tables

5.1.4 Summary Statistics

Critical Pathway Dose Report

1999-2007 SCDHEC Media Detected Dose (Millirem) Averages Within 50 Miles of the SRS 424

Average Dose (Millirem) Rank By Radionuclide (Includes NORM) 424

Notes:
1 – The summary statistics that follow are by media dose source and radionuclide dose source.
2 – DNRGW stands for the Department of Natural Resources groundwater wells sampled off SRS, and is used to represent the dose potential in private wells located within the study area.
3 – PWSGW stands for the public water supplies groundwater wells and represents the dose to the public that has a PWSGW source as their water supply (not on the Savannah River).
4 – PWSRW stands for the public water supplies river water sources and represents the dose to the public that has a PWSRW source as their water supply. Examples include the City of Savannah and the Beaufort-Jasper area.
5 – Sediment dose was typically less than 0.005 mrem in past years, and SCDHEC shifted to riverbank sediments in 2007 as more representative of potential dose to the public at these locations.
6 – TLD is thermoluminescent dosimeter detections that result from direct exposure to air, vegetation, and soil beta-gamma sources.
7 – These summary tables are given only on an average basis (average detection per media per radionuclide minus the respective background). Other tables within section four address the potential dose that could occur from a single maximum dose per media per radionuclide sustained for a year at a maximum exposure rate.
8 – Note that the unspeciated dose categories (alpha and beta) that were assigned at maximum dose potential (Pu-239 and Sr-90) clearly bias the potential dose on the high side. The use of averages instead of medians and the assignment of unspeciated dose are the main factors that contribute to this protective estimate of potential dose to the public and the MEI.

Back to List of Summary Statistics

Summary Statistics Back to List of Summary Statistics

Table 1. 1999-2007 SCDHEC Media Detected Dose (Millirem) Averages Within 50 Miles of an SRS Center Point (Excluding NORM)

Media	1999-2007 Total mrem	ALL Media Average Basis %	1999-2007 Statistics Avg.	SD	Median
Surface Water Boat Landings	0.560	2.65	0.06	0.03	0.06
DNRGW (private well potential)	0.225	1.07	0.05	0.06	0.02
PWSGW (public well potential)	0.177	0.84	0.02	0.02	0.01
PWSRW (Savannah River)	0.279	1.32	0.03	0.02	0.03
Rainwater (private cistern potential)	0.099	0.47	0.01	0.01	0.01
Soil	0.350	1.66	0.04	0.08	0.01
Sediment (Wade+Riverbank in 2007)	0.175	0.83	0.02	0.06	0.00
TLD (beta-gamma)	6.690	31.71	0.74	1.12	0.00
Air	0.064	0.30	0.01	0.01	0.01
Edible Vegetation	0.164	0.78	0.03	0.05	0.01
Milk	0.566	2.68	0.06	0.08	0.04
Fish	4.406	20.89	0.49	0.26	0.44
Deer	2.750	13.04	0.34	0.49	0.15
Hog	4.590	21.76	1.53	1.87	0.97
Totals	21.095	100.00	3.43	NA	1.75

Notes: See acronyms for abbreviation definitions.

Table 2. Average Dose (millirem) Rank by Radionuclide (includes NORM)

1999-2007	Sum	%	Avg	SD	Median	2007	Sum	%	Avg	SD	Median
Total	36.78	99.99				Total	4.88	99.96			
Cs-137	14.35	**39.00**	0.53	0.95	0.21	alpha	1.56	31.95	0.52	0.77	0.10
alpha	7.13	19.37	0.40	0.72	0.05	Ra-226	1.31	26.89	0.66	0.26	0.66
b-gamma	6.69	18.19	0.84	1.16	0.00	**Cs-137**	0.82	**16.86**	0.27	0.37	0.11
Ra-226	4.85	13.20	0.61	0.54	0.66	Pb-214	0.29	6.00	0.10	0.08	0.11
H-3	0.67	**1.83**	0.01	0.01	0.01	beta	0.26	5.23	0.09	0.13	0.01
Sr-89/90*	0.58	**1.58**	0.08	0.10	0.01	Pb-212	0.15	3.16	0.08	0.01	0.08
Pb-214	0.51	1.39	0.09	0.06	0.09	Ac-228	0.15	3.09	0.08	0.05	0.08
Ac-228	0.50	1.35	0.10	0.04	0.11	**Sr-89/90***	0.14	**2.95**	0.05	0.07	0.01
beta	0.35	0.94	0.03	0.06	0.01	**H-3**	0.09	**1.84**	0.01	0.02	0.01
Pb-212	0.24	0.66	0.06	0.02	0.06	Th-234	0.06	1.17	0.03	0.02	0.03
Sr-89	0.19	0.50	0.06	0.09	0.01	**Am-241**	0.04	0.82	0.04	NA	0.04
Ra-228	0.19	0.50	0.09	0.02	0.09	**Sr-89**	0.00	0.00	NA	NA	NA
U-234	0.15	0.40	0.15	NA	0.15	**Sr-90**	0.00	0.00	NA	NA	NA
Eu-155	0.12	0.32	0.06	0.07	0.06	**U-234**	0.00	0.00	NA	NA	NA
Zn-65	0.07	0.20	0.07	NA	0.07	**U-235**	0.00	0.00	NA	NA	NA
U-238	0.06	0.16	0.01	0.01	0.01	**U-238**	0.00	0.00	NA	NA	NA
Th-234	0.06	0.15	0.03	0.02	0.03	Ra-228	0.00	0.00	NA	NA	NA
Am-241	0.04	0.11	0.04	NA	0.04	b-gamma	0.00	0.00	NA	NA	NA
U-235	0.03	0.07	0.01	0.00	0.01	**Pu-239/240**	0.00	0.00	NA	NA	NA
Sr-90	0.01	0.03	0.01	0.00	0.01	**Am-243**	0.00	0.00	NA	NA	NA
Am-243	0.00	0.01	0.00	NA	0.00	**Pu-238**	0.00	0.00	NA	NA	NA
Pu-239/240*	0.00	0.01	0.00	0.00	0.00	**Pu-239**	0.00	0.00	NA	NA	NA
Pu-238	0.00	0.00	0.00	NA	0.00	**Ce-144**	0.00	0.00	NA	NA	NA
Tc-99	0.00	0.00	0.00	NA	0.00	**Tc-99**	0.00	0.00	NA	NA	NA
Pu-239	0.00	0.00	NA	NA	NA	**Eu-155**	0.00	0.00	NA	NA	NA
Ce-144	0.00	0.00	0.00	NA	0.00	**Zn-65**	0.00	0.00	NA	NA	NA

References

Absalom, J.P.; Young, S.D.; Crout N.M.J.; Sanchez A.; Wright, S.M.; Smolders, E.; Nisbet, A.F. and Gillett A.G. 2001. Predicting the Transfer of Radiocaesium from Organic Soils to Plants Using Soil Characteristics. Journal of Environment Radioactivity, vol. 52, no. 1, p. 31-43.

Alloway, B.J., 1995. Heavy Metals in Soils. Great Britain, St Edmundsbury Press, Suffolk.

Argonne National Laboratory (ANL). 2007. Health-Based Radionuclide Concentrations in Drinking Water and Air. Human Health Fact Sheet.

ANL. 2007. Radiological and Chemical fact Sheets to Support Health risk Analyses for Contaminated Areas. www.evs.anl.gov/pub/doc/ANL_ContaminantFactSheets_All_070418.pdf.

Bond, V.P., T.M. Fliedner, and J.O. Archambeau. 1965. Mammalian Radiation Lethality. Academic Press, New York, p. 340.

Botsch. 1999. Investigation of the Radiation Exposure of Inhabitants of Contaminated Areas in Northern Ukraine. Center for Radiation Protection and Radioecology, University of Hanover, Germany and the State Agroecological Academie of Ukraine, Ukraine.

Brisbin, I.Lehr, Jr., and M.H. Smith. 1975. Radiocesium Concentrations in Whole-Body Homogenates and Several Body Compartments of Naturally Contaminated White-tailed Deer. In Mineral Cycling in the Southeastern Ecosystems, ERDA Symposium Series, CONF-740513, National Technical Information Service, Springfield, Virginia, p. 542.

Canova, J.L., 1999. Elements in South Carolina Inferred Background Soil and Stream Sediment Samples. South Carolina Geology, 1999, v.41, p.11-25.

Centers of Disease Control (CDC) SRS Health Effects Subcommittee (SRSHES). 1997. Dose Reconstruction News. "Estimating the Atmospheric Tritium Source Term at SRS: A Progress Report", Vol II #3.

CDC. 2004. "Draft for Public Comment" of Phase III Savannah River Site (SRS) Dose Reconstruction Project for the SRS Health Effects Subcommittee (SRSHES). Radiation Studies Branch, National Center for Environmental Health, Centers for Disease Control and Prevention of the U. S. Department of Health and Human Services.

CDC. 2006. Phase III of the SRS dose reconstruction project. Available from URL http://www.cdc.gov/nceh/radiation/Savannah/docs/TOCs.pdf

References

Corey, J.C. 1980. Transport of Radionuclides Through Soil and Groundwater. E. I. DuPont de Nemours and Company, Savannah River Plant, Aiken, SCDP-MS-80-95.

Cummins, C.L. 1994. Radiological Bioconcentration Factors for Aquatic, Terrestrial, and Wetland Ecosystems at the Savannah River Site (U). Prepared for the United States Department of Energy, Savannah River Site. Aiken, South Carolina.

Davis, J.J. 1963. Cesium and its Relationships to Potassium in Ecology, in Radioecology. Colorado State University, Fort Collins, Colorado, pp. 539-556.

Department of Energy (DOE) 2006. Stakeholder Sensitivity To Tritium Releases. Retrieved May 22, 2007 from http://hss.energy.gov/CSA/csp/advisory/SAd_2006-04.pdf

Duke, COGEMA, Stone, and Webster. 1998. Mixed Oxide Fuel Fabrication Facility Environmental Report. Charlotte, NC. Docket Number 070-03098.

Du Pont, 1984. United States Department of Energy, Savannah River Plant Environmental Report For 1984, E. I. du Pont de Nemours and Company, Savannah River Plant, Aiken, South Carolina.

Entry, J.A., Vance, N. C., Hamilton, M. A., Zabowski, D., Watrud, L. A., and Adriano, D. 1996. Phyto remediation of Soils Contaminated with Low Concentrations of Radionuclides. Water, Air, and Soil Pollution 88, 167-176.

Federal Register. 1998. Vol.63. No. 121. Wednesday. June 24, 1998, Notices. 34491.

Hanlon, Edward A., 2004. Naturally Occurring Radionuclides in Agricultural Products, December 2004, University of Florida, Institute of Agricultural and Food Sciences (IAFS), Florida Cooperative Extension Service.

Haselow, L.A. 1991. The Relationship of Radiocesium and Potassium In The Nutritional Ecology of White-tailed Deer From the Savannah River Site. Masters Thesis, Purdue University, p. 1.

Heckman JR, Kamprath EJ. 1992. Potassium Accumulation and Corn Yield Related to Potassium Fertilizer Rate and Placement. P141-149

Johnson, A. 2000. Reconnaissance Survey on Metals, Semivolatiles, and PCBs in Sediment Deposits Behind Upriver Dam, Spokane River. Publication No. 00-3-021.Washington State Department of Ecology, Olympia, Washington.

Kathren, R.L. 1984. Radioactivity in the Environment: Sources, Distribution, and Surveillance. Harwood Academic Publishers, New York, New York.

References

Larson, B.L. and K. E. Ebner. 1958. Significance of Strontium-90 in Milk. A Review. Journal of Diary Science. 41(12):1647-1662.

Lawrence Livermore National Laboratory (LLNL). 1997. Site Annual Environmental Report, UCRL-50027-97, Oakland, California.

Linkov and W. R. Schell (eds.). 1999. Contaminated Forests: Recent Developments in Risk Identification and Future Perspectives, Kluewer, Amsterdam.

Michigan. 2002. DEQ Sampling Strategies and Statistics Training Materials for Part 201Cleanup Criteria. Michigan Department of Environmental Quality Remediation And Redevelopment Division.

Mineral Information Institute (MII). 2008. www.mii.org/Minerals/photostrontium

National Council on Radiation Protection and Measures (NCRP). 1984. Radiological Assessment: Predicting the Transport, Bioaccumulation, and Uptake by Man of Radionuclides Released to the Environment. NCRP Report No. 76, Bethesda, MD.

NFEC, 1999. Handbook for Statistical Analysis of Environmental Background Data. Prepared by SWDIV and EFA WEST of the Naval Facilities Engineering Command.

Norton, D., M. Stinson, B. Yake. 1987. Investigation of 4-Methylphenol in Bottom Sediments from Log Rafting Areas of Commencement Bay, Washington. WA-10-0020.Washington State Department of Ecology, Olympia, Washington.

Pacific Northwest Laboratory (PNL). 2004. 8.8 Food and Farm Products Monitoring, Hanford Site Environmental Report for Calendar Year , DE-AC05-76RL01830, Department of Energy-Hanford Site, Richland, Washington.

RADNET. 2006. Information about source points of anthropogenic radioactivity, A Freedom of Nuclear Information Resource, http://www.davistownmuseum.org/cbm/, Chernobyl Plume: Country-by-Country.

Rommelt, R., Hiersche, L., Schaller, G., and Wirth, E. 1990. Influence of soil fungi (Basidiomycetes) on the migration of Cs134 + 137 and Sr90 in coniferous forest soil. In: Transfer of Radionuclides in Natural and Semi-Natural Environments (eds. G. Desmet, P. Nassimbeni and M. Belli), Elsevier Applied Science, London, New York.

Rosson, R., S. Klima, B. Kahn, and P. Fledderman. 2000. Correcting Tritium Concentrations in Water Vapor Monitored with Silica Gel. Health Physics, Volume 78, Number 1, pp.68-73, Williams & Wilkins, Baltimore, MD.

SAS™, release 9.1. The SAS System for Windows. SAS/STAT software. The SAS Institute Inc., SAS Campus Drive, Cary, North Carolina 27513.

References

Savannah River Site. 2008. Historical History Web Interface URL: http://www.srs.gov/general/about/history1.htm

Sears, Rhonda. 2005. USEPA National Air and Radiation Environmental Laboratory. Montgomery, AL. Telephone Conversation September 17, 2005.

Seel, J. F., Whicker, F. W., and Adriano, D. C. 1995. Uptake of Cs-137 in Vegetable Crops Grown on a Contaminated Lakebed, 1995 Health Physics Society manuscript.

Smith, S.K. 2008. Letter to Sisario, Kelly. August 12, 2008. Self-Disclosure for Potential Non-Compliance with Emergency Planning and Community Right-To-Know Act of 1986 (EPCRA) Section 313 Regarding Under-reporting of Nitrate Releases in the Toxic Chemical Release Forms.

South Carolina Department of Health and Environmental Control (SCDHEC). 1998a. *Water Classifications and Standards* (Regulation 61-68), Bureau of Water Pollution Control, Division of Water Quality Assessment and Enforcement, Columbia, South Carolina.

SCDHEC. 1998b. Summary of Selected Water Quality Parameter Concentrations in South Carolina Waters and Sediments January 1, 1993 - December 31, 1997, Technical Report No. 004-98, Bureau of Water Pollution Control, Division of Water Quality Assessment and Enforcement, Columbia, South Carolina.

SCDHEC. 1999a. Determination of Ambient Groundwater Quality Adjacent to the Savannah River Site, Annual Report, 1997, SCDHEC Environmental Surveillance and Oversight Program, Aiken, South Carolina .

SCDHEC. 1999b. Standard Operating Procedures for the Environmental Surveillance and Oversight Program, Bureau of Environmental Services, Environmental Surveillance and Oversight Program, Aiken, South Carolina .

SCDHEC. 2000. South Carolina Department of Health and Environmental Control 1999 Environmental Data Report, Bureau of Environmental Services, Environmental Surveillance and Oversight Program, Aiken, South Carolina .

SCDHEC. 2001a. Environmental Surveillance and Oversight Program Field Monitoring Procedures, Bureau of Environmental Services Environmental Surveillance and Oversight Program, Aiken, South Carolina .

SCDHEC. 2001b. Standard Operating Procedures for the Environmental Surveillance and Oversight Program, Bureau of Environmental Services Environmental Surveillance and Oversight Program, Aiken, South Carolina .

References

SCDHEC. 2001c. South Carolina Department of Health and Environmental Control 2000 Environmental Data Report, Bureau of Environmental Services, Environmental Surveillance and Oversight Program, Aiken, South Carolina.

SCDHEC. 2002. South Carolina Department of Health and Environmental Control 2001 Environmental Data Report, Bureau of Environmental Services, Environmental Surveillance and Oversight Program, Aiken, South Carolina.

SCDHEC. 2003. South Carolina Department of Health and Environmental Control 2002 Environmental Data Report, Bureau of Environmental Services, Environmental Surveillance and Oversight Program, Aiken, South Carolina.

SCDHEC. 2004a. 2003 Radiological Atmospheric Monitoring Project Data Report, Bureau of Environmental Services, Environmental Surveillance and Oversight Program, Aiken, South Carolina.

SCDHEC. 2004b. South Carolina Department of Health and Environmental Control 2003 Environmental Data Report, Bureau of Environmental Services, Environmental Surveillance and Oversight Program, Aiken, South Carolina.

SCDHEC. 2005a. South Carolina Department of Health and Environmental Control 2004 Environmental Data Report, Bureau of Environmental Services, Environmental Surveillance and Oversight Program, Aiken, South Carolina.

SCDHEC. 2005b. Standard Operating Procedures for the Environmental Surveillance and Oversight Program, Bureau of Environmental Services, Environmental Surveillance and Oversight Program, Aiken, South Carolina.

SCDHEC. 2006a. 2006 Radiological Monitoring of Drinking Water Adjacent to the Savannah River Site, Bureau of Environmental Services, Environmental Surveillance and Oversight Program, Aiken, South Carolina.

SCDHEC. 2006b. South Carolina Department of Health and Environmental Control 2005 Environmental Data Report, Bureau of Environmental Services, Environmental Surveillance and Oversight Program, Aiken, South Carolina.

SCDHEC. 2006c. 2006 Nonradiological Surface Water Quality Monitoring Report, Bureau of Environmental Services, Environmental Surveillance and Oversight Program, Aiken, South Carolina.

SCDHEC. 2007a. 2006 Radiological Atmospheric Monitoring Data Report, Bureau of Environmental Services, Environmental Surveillance and Oversight Program, Aiken, South Carolina

References

SCDHEC. 2007b. South Carolina Department of Health and Environmental Control 2006 Environmental Data Report, Bureau of Environmental Services, Environmental Surveillance and Oversight Program, Aiken, South Carolina.

SCDHEC. 2007c. State of South Carolina Monitoring Strategy, Technical Report No. 001-07, Bureau of Water, Water Quality Monitoring Section, Columbia, South Carolina.

SCDHEC. 2007d. 2006 Report on Monitoring of Terrestrial Vegetation Related to the Savannah River Site, Bureau of Environmental Services, Environmental Surveillance and Oversight Program, Aiken, South Carolina.

SCDHEC. 2007e. 2006 Radiological Monitoring of Milk from Dairies Surrounding the Savannah River Site. Bureau of Environmental Services, Environmental Surveillance and Oversight Program, Aiken, South Carolina.

SCDHEC. 2007f. 2006 Radiological Monitoring of Fish Associated with the Savannah River Site, Bureau of Environmental Services, Environmental Surveillance and Oversight Program, Aiken, South Carolina.

SCDHEC. 2007g. 2007 Critical Pathway Dose Project Plan, Bureau of Environmental Services, Environmental Surveillance and Oversight Program, Aiken, South Carolina.

SCDHEC. 2008. 2008 South Carolina Fish Consumption Advisories. Division of Health Hazard Evaluation. Columbia, South Carolina.

Till, J.E., et al. 2001. Savannah River Site Environmental Dose Reconstruction Project, Phase II: Source Term Calculation and Ingestion Pathway Data Retrieval, Evaluation of Materials Released From the Savannah River Site. RAC Report No. 1-CDC-SRS-1999-Final. Risk Assessment Corporation (RAC).

United States Department of Energy. 1995. SRS Waste Management Final Environmental Impact Statement. Doc. No. DOE/EIS-0217 http://www.eh.doe.gov/nepa/eis/eis0217/eis0217_toc.html

United States Department of Interior (USDOI). 1992. 7.5 Minute Topographic Geologic Survey Map of South Carolina. South Carolina Land Resources Commission RV 10/92

United States Environmental Protection Agency (USEPA). 1987. An Overview of Sediment Quality in the United States, EPA-905/9-88-002, Office of Water Regulations and Standards, Washington, DC and Region 5, Chicago, IL.

USEPA. 2000a. Practical Methods for Data Analysis, Guidance for Data Quality Assessment, EPA QA/G-9, QA00 Update.

References

USEPA. 2000b. Guidance For Assessing Chemical Contaminant Data for use in Fish Advisories, Vol. 1.

USEPA. 2002a. National Primary Drinking Water Regulations. Title 40, Chapter 1, Part 141.

USEPA. 2002b. "List of Drinking Water Contaminants & MCLs", EPA 816-F-02-013 (July 2002).

USEPA. 2002c. EPA Facts About Strontium-90. http://www.epa.gov/superfund/health/contaminants/radiation/pdfs/strontium.pdf

USEPA. 2003. National Primary Drinking Water Standards, EPA-816-F-03-016. Office of Water, Washington DC

USEPA. 2004. Preliminary Remediation Goals. www.epa.gov/region9/waste/sfund/prg/files/04soils.pdf

USEPA. 2005. Office of Radiation and Indoor Air, Environmental Radiation Data, Report 123 July - September, Montgomery, AL.

USEPA. 2007. US EPA Information. www.epa.gov/radiation/radionuclides.

USEPA. 2008a. http://www.epa.gov/safewater/contaminants/index.html

USEPA. 2008b. National Primary Drinking Water Regulations; Radionuclides; Final Rule.Updated October, 2008.

United States Geological Survey (USGS). 2000. Water Quality in the Santee River Basin and Coastal Drainages, North and South Carolina, 1995-1998: U.S Geological Survey Circular 1206, 32p., http://pubs.water.usgs.gov/circ1206/

Walter, A. E., 1995. America the Powerless, Facing our Nuclear Energy dilemma, Library of Congress Card Number: 95-080187.

Westinghouse Savannah River Company (WSRC). 1993. Assessment of Technetium In the Savannah River Site Environment. Carlton, W.H., Denham, M., Evans, A.G., Aiken, South Carolina. WSRC-TR-93-217.

WSRC. 1997. Assessment of SRS Radiological Liquid and Airborne Contaminants and Pathways. Jannik, G.T.,Westinghouse Savannah River Company, Savannah River Site, Aiken, South Carolina. WSRC-TR-970152.

WSRC. 1998. Assessment of Radionuclides in The Savannah River Site Environment-Summary (U), Environmental Protection Department, Environmental Monitoring Section, Aiken, South Carolina. WSRC-TR-98-00162

References

WSRC. 1999a. Savannah River Site Environmental Report for 1998. Environmental Monitoring Section, Environmental Protection Department, Westinghouse Savannah River Company Aiken, South Carolina. WSRC-TR-99-00299.

WSRC. 1999b. Radionuclides in the Savannah River Site Environment. Westinghouse Savannah River Company, Aiken, South Carolina. WSRC-MS-99-00667.

WSRC. 2000a. Savannah River Site Environmental Data for 1999, Environmental Monitoring Section, Environmental Protection Department, Westinghouse Savannah River Company Aiken, South Carolina. WSRC-TR-99-00301.

WSRC. 2000b. Savannah River Site Environmental Report for 1999. Environmental Monitoring Section, Environmental Protection Department, Westinghouse Savannah River Company, Aiken, South Carolina. WSRC-TR-99-00299.

WSRC. 2001. Savannah River Site Environmental Report for 2000. Savannah River Site. Westinghouse Savannah River Company, Aiken, SC. WSRC-TR-2000-00328.

WSRC. 2002a. Savannah River Site Environmental Report for 2001. Environmental Monitoring Section, Environmental Protection Department. Westinghouse Savannah River Company, Aiken, South Carolina. WSRC-TR-2001-00474.

WSRC. 2002b. Viability of Sodium Iodide Detector Field Measurements and X-Ray Florescence Measurements for Recognition of Benchmark Exceedances in the Steel Creek Integrator Operable Unit. Westinghouse Savannah River Company, Aiken, South Carolina.

WSRC. 2003a. Savannah River Site Environmental Report for 2002. Environmental Monitoring & Analysis, Environmental Services Section, Westinghouse Savannah River Company, Aiken, SC. WSRC-TR-2003-00026

WSRC. 2003b. Radiological False Positives in Environmental Soil and Groundwater Data From Commercial Laboratories. Westinghouse Savannah River Company, Savannah River Site, Aiken, South Carolina. WSRC-MS-2003-00565.

WSRC. 2004. Savannah River Site Environmental Report for 2003. Environmental Monitoring & Analysis, Environmental Services Section, Westinghouse Savannah River Company, Aiken, SC. WSRC-TR-2004-00015.

WSRC. 2005a. Savannah River Site Environmental Report for 2004. Environmental Monitoring & Analysis, Environmental Services Section, Westinghouse Savannah River Company, Aiken, SC. WSRC-TR-2005-00005.

WSRC. 2005b. Ecological Screening Values for Surface Water, Sediment, and Soil: 2005 Update, Friday, G.P., Westinghouse Savannah River Company, Savannah River Site, Aiken, South Carolina.WSRC-TR-2004-00227.

References

WSRC. 2006. Savannah River Site Environmental Report for 2005. Washington Savannah River Company, Savannah River Site, Aiken, SC. WSRC-TR-2006-00007

WSRC. 2007. Savannah River Site Environmental Report for 2006. Washington Savannah River Company, Savannah River Site, Aiken, SC. WSRC-TR-2007-00008.

WSRC. 2008a. Savannah River Site Environmental Report for 2007. Washington Savannah River Company, Savannah River Site, Aiken, SC. WSRC-STI-2008-00057.

WSRC. 2008b. Facts about the Savannah River Site, *SRS Tritium Facilities*, January 2008.

Yoshida, S., and Muramatsu, Y., 1998. Concentrations of alkali and alkaline earth elements in mushrooms and plants collected in a Japanese pine forest, and their relationship with Cs137. J. Environ. Radioactivity 41, 183-205.

Back to Table of Contents

Errata

From 2006 Report

The following information was reported incorrectly in the *Environmental Surveillance and Oversight Program Data Report for 2006*.

The 2006 Data Report incorrectly reported in chapter 2.5 (Radiological and Nonradiological Monitoring of Sediments) that iodine-129 activity was detected in four samples, plutonium-238 activity was detected in one sample, plutonium-239 was detected in one sample, and total strontium and technetium-99 were detected in all five samples.

A correction should be made that there were no detections above the MDC for I-129, Pu-238, and Pu-239. There were four Total Strontium detections and one Tc-99 detection. The data from the contract lab performing the analysis listed results for all samples. However, the results were below the MDC for all the samples except for the four Total Strontium and Tc-99 detections. Because the MDC was not included in the 2006 Data Report, it was incorrectly concluded that there were more detections. In addition, the data tables have been corrected to show the LLDs and MDCs for all 2006 sediment samples.

Corrected 2006 Sediment Data Tables:

2006 Sediment Summary Statistics	median	average	SD	Max	Min	Number
Gross Alpha	16.85	14.73	5.88	18.90	6.30	4
N-V Beta	17.10	17.83	13.18	49.30	4.01	13
Cesium-137	0.303	0.337	0.194	0.695	0.115	7
Iodine-129	N/A	N/A	N/A	N/A	N/A	0
Plutonium-238	N/A	N/A	N/A	N/A	N/A	0
Plutonium-239	N/A	N/A	N/A	N/A	N/A	0
Total Strontium	0.696	0.714	0.241	1.020	0.444	4
Technetium-99	0.424	0.424	N/A	0.424	0.424	1

Location Description	SMSV-2040	SMSV-2018	SMSV-2062	SMSV-2071	SMSV-2010
Collection Date	11/13/06	11/13/06	11/14/06	11/14/06	11/14/06
PU-238 pCi/g	<MDC	<MDC	<MDC	<MDC	<MDC
PU-238 pCi/g Total Propagation of Uncertainty	NA	NA	NA	NA	NA
PU-238 pCi/g MDC	0.0129	0.0173	0.0183	0.0181	0.0161
PU-239 pCi/g	<MDC	<MDC	<MDC	<MDC	<MDC
PU-239 pCi/g Total Propagation of Uncertainty	NA	NA	NA	NA	NA
PU-239 pCi/g MDC	0.0223	0.0204	0.0216	0.0218	0.0200
TOTAL Sr pCi/g	**0.634**	<MDC	**0.758**	**1.02**	**0.444**
TOTAL Sr pCi/g Total Propagation of Uncertainty	**0.363**	NA	**0.370**	**0.38**	**0.188**
TOTAL Sr pCi/g MDC	**0.590**	0.436	**0.595**	**0.595**	**0.297**
TC-99 pCi/g	<MDC	**0.424**	<MDC	<MDC	<MDC
TC-99 pCi/g Total Propagation of Uncertainty	NA	**0.234**	NA	NA	NA
TC-99 pCi/g MDC	0.309	**0.380**	0.294	0.291	0.301

Errata

Corrected 2006 Sediment Data Tables:

Location Description	SMSV-2049	SMSV-2040	SMSV-2048	SMSV-2018	SMSV-2062
Collection Date	**11/13/06**	**11/13/06**	**11/13/06**	**11/13/06**	**11/14/06**
Alpha Activity	<LLD	<LLD	<LLD	<LLD	<LLD
Alpha Confidence Interval					
Alpha LLD	21.3	26.9	34	23.6	22.4
Beta Activity	**4.01**	<LLD	**49.3**	**31.0**	**7.27**
Beta Confidence Interval	**2.34**		**8.06**	**4.24**	**2.63**
Beta LLD	**3.94**	4.08	**8.96**	**4.32**	**4.01**
Cs-137 Activity	0.4377	<MDA	<MDA	**0.3461**	<MDA
Cs-137 Confidence Interval	0.05611	NA	NA	**0.06035**	NA
Cs-137 MDA	0.02899	0.01979	0.08485	**0.04040**	0.02549
I-129 pCi/g	<MDC	<MDC	<MDC	<MDC	<MDC
I-129 pCi/g Total Propagation of Uncertainty	NA	NA	NA	NA	NA
I-129 pCi/g MDC	0.231	0.180	0.215	0.209	0.142

Location Description	SMSV-2069	SMSV-2071	SMSV-2010	SMSV-2073	SMSV-2011
Collection Date	**11/14/06**	**11/14/06**	**11/14/06**	**11/14/06**	**11/20/06**
Alpha Activity	<LLD	<LLD	<LLD	<LLD	<LLD
Alpha Confidence Interval					
Alpha LLD	29.0	26.2	22.1	24.2	12.5
Beta Activity	**1.85**	**7.71**	**16.5**	**23.2**	**28.1**
Beta Confidence Interval	**6.66**	**2.89**	**3.62**	**4.76**	**7.62**
Beta LLD	**9.95**	**4.45**	**4.65**	**5.87**	**11.2**
Cs-137 Activity	**0.1799**	<MDA	<MDA	**0.1154**	**0.4812**
Cs-137 Confidence Interval	**0.05577**	NA	NA	**0.05098**	**0.07896**
Cs-137 MDA	**0.05978**	0.02649	0.03270	**0.05176**	**0.06245**
I-129 pCi/g	<MDC	<MDC	<MDC	<MDC	<MDC
I-129 pCi/g Total Propagation of Uncertainty	NA	NA	NA	NA	NA
I-129 pCi/g MDC	0.146	0.204	0.159	0.187	0.238

Location Description	SMSV-2013	SMSV-2015	SMSV-2017	SMSV-2020
Collection Date	**11/20/06**	**11/20/06**	**11/20/06**	**11/20/06**
Alpha Activity	**18.6**	**15.1**	**6.30**	**18.9**
Alpha Confidence Interval	**12.1**	**9.2**	**5.50**	**16.5**
Alpha LLD	**10.8**	**7.84**	**5.87**	**17.6**
Beta Activity	**19.6**	**17.1**	**6.87**	**19.3**
Beta Confidence Interval	**4.61**	**4.23**	**3.62**	**4.82**
Beta LLD	**6.64**	**6.19**	**6.22**	**7.15**
Cs-137 Activity	<MDA	**0.1782**	**0.6950**	**0.2606**
Cs-137 Confidence Interval	NA	**0.03433**	**0.07149**	**0.05126**
Cs-137 MDA	0.03992	**0.02970**	**0.02677**	**0.03338**
I-129 pCi/g	<MDC	<MDC	<MDC	<MDC
I-129 pCi/g Total Propagation of Uncertainty	NA	NA	NA	NA
I-129 pCi/g MDC	0.224	0.187	1.80	0.169

Back to Table of Contents